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PHILIPPINE WATER REVOLVING FUND FOLLOW-ON PROGRAM

MODEL CONTRACT FRAMEWORK FOR LEAKAGE REDUCTION AND MANAGEMENT CONTRACT USING THE REHABILITATE-OPERATE-TRANSFER MODEL FOR PHILIPPINE WATER DISTRICTS

May 2013

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MODEL CONTRACT FRAMEWORK FOR LEAKAGE REDUCTION AND MANAGEMENT CONTRACT USING THE REHABILITATE-OPERATE-TRANSFER MODEL FOR PHILIPPINE WATER DISTRICTS

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ACRONYMS

BOQ	-	Bill of Quantities
BOT	-	Build Operate and Transfer
DMA	-	District Meter Area
DWLB	-	DMA Water Loss Baseline
IRR	-	Implementing Rules and Regulations
MWL	-	Monthly Water Loss
PDFM	-	Project Development and Monitoring Facility
PPPC	-	Public-Private Partnership Center
ROT	-	Rehabilitate Operate and Transfer
USAID	-	United States Agency for International Development

I. INTRODUCTION

This document sets out a model contract framework for a performance-based leakage reduction and management contract using the Rehabilitate Operate and Transfer (ROT) model.

Under the legal framework in the Philippines, the Build Operate and Transfer Law (Republic Act No. 6957, as amended by Republic Act No. 7718) best accommodates the elements of performance-based contracts to reduce non-revenue water. The BOT Law provides a stable legal framework for undertaking performance-based contracting for non-revenue water reduction. Moreover the approvals process under the BOT Law provides better safeguards for Water Districts undertaking non-revenue water reduction projects under performance-based arrangements than other alternatives.

Also, taking the BOT Law route will permit the Water District to tap the Project Development and Monitoring Facility (PDMF), established under Executive Order No. 8 and administered by the Public-Private Partnership Center (PPPC), to finance: feasibility studies, bidding document preparation and proposal evaluation assistance.

The model contract framework is not a contract template, but it provides example contract language covering selected technical aspects of a project to reduce NRW, and it sets out the mandatory contract provisions that must be included in ROT model contract to comply with the BOT Law.

The model contract framework incorporates two key assumptions. It assumes that the contractor will:

1. Finance most of the activities under the contract, including the capital investments of establishing district metered areas, leak detection and pipe repairs or replacement within the DMAs and
2. Be compensated based on the value of the water saved, as if it were sold by the utility to retail customers.

The model contract framework reflects the following contract structure:

1. The contract duration will depend on the time it will take for the contractor to recover its investment through the performance fee. The contract duration could

be up to 10 years, with a first phase of up to 5 years to complete leakage reduction activities (the Leakage Reduction and Management period) and a 5-year Maintenance Period during which the level of water savings has to be maintained, and during which the contractor will recover its investment plus a profit.

2. Contract loss reduction activities will focus on: 1) reducing physical losses - through leakage detection and repair, pressure management and asset management; 2) identifying illegal connections; and 3) improving meter accuracy.
3. The contractor will finance most of the project activities. However, should cost sharing be necessary, the Water District, based on the BOT Law may finance up to 50% of the project, such as the replacement of customer meters, pipes, etc.
4. The contractor will be paid a performance fee per cubic meter of water saved, monthly in arrears, equivalent to a percentage of the tariff per cubic meter.
5. The contractor will establish District Meter Areas (DMAs) according to a plan agreed with the Water District. The contract will contain minimum annual targets for the number of DMAs to be established. Liquidated damages will be due from the contractor for each month of delay in meeting the minimum targets, after a one-month grace period.
6. Upon establishment of a DMA, a NRW baseline will be agreed between the contractor and the Water District, after which the contractor will take possession of the DMA; defined as from the boundary valve up to the customer meters. The contractor will be responsible for the operation and maintenance of the DMA, including leak detection and repair, pressure management and asset management, including pipe replacement from the time the DMA is established until it is transferred back to the Water District at the end of the contract.
7. Minimum annual water loss targets will be agreed. Liquated damages will be due from the contractor for missing an annual target, after a 30-day grace period.
8. The contractor will replace customer meters within the DMA and make all changes to the network within the DMA to accommodate system expansion, or to respond to emergencies or for other purposes both inside and outside of the DMA, as requested by the Water District. The Water District will compensate the contractor for customer meter replacement and all NRW reduction activities according to unit prices per a bill of quantities agreed with the Water District.

The model contract framework also contains--for information purposes only -- sample technical specifications for equipment and materials, and for installation and repair works drawn from leakage reduction and management contract guidance developed by

the World Bank. Technical specifications used by the Philippine Water Districts, must conform to Philippine laws and regulations.

Before procuring a Leakage Reduction and Management contractor, Water Districts will need to undertake a feasibility study, including the preparation of:

- A Water Balance for the hydraulically discrete part of the water supply network that will be covered by the contract,
- The DMA Design and Establishment Plan,
- Technical specifications for construction works ,
- A financial model to estimate the cost of the project and the duration of the Maintenance Period needed for the contractor to recover its investment through the performance fee, considering the annual targets for establishing DMAs and the estimated annual water loss reduction considering hours of supply if the network is not currently able to provide 24/7 water; and
- Bidding documents.

Procurement would be conducted using the two envelope method with the technical evaluation conducted first on a pass/fail basis and then price, with the contract awarded to the lowest price bidder.

Bid Price will be the sum of two components:

1. The Performance fee, stated as a base rate per cubic meter – essentially a portion of the tariff per cubic meter - of water saved, with a hypothetical quantity of water saved will be used for evaluation purposes); and

2. Unit prices included in a Bill of Quantities (BOQ) for System Expansion or Customer Meter Replacement, with hypothetical item quantities used for evaluation purposes.

II. MANDATORY PROVISIONS REQUIRED BY THE BOT LAW

A. GENERAL

1. The Revised Implementing Rules and Regulations of R.A. No. 6957, "An Act Authorizing the Financing, Construction, Operation and Maintenance of Infrastructure Projects by the Private Sector and for Other Purposes", as amended by R.A. No. 7718 ("Revised IRR") states in Section 4.4 that the draft contract should clearly define the basic and legal relationship between the parties and their rights and responsibilities including the specific government undertakings to be provided by the implementing agency, or in this case the Water District. The Revised IRR further requires that the draft contract shall have the following mandatory terms and conditions:

    1.1 Specific contractual arrangement, term, and scope of work;

    1.2 Project technical specifications and system features;

    1.3 Implementation milestone, including those for securing other approvals, project completion date;

    1.4 Cost recovery scheme via proposed tolls, fees, rentals and charges, as the case may be;

    1.5 Liquidated damages;

    1.6 Performance and warranty bonds;

    1.7 Minimum insurance coverage as may be required for the project, such as contractor's all risk, motor vehicle, workmen's compensation, third party liability, or comprehensive general liability insurance;

    1.8 Acceptance tests and procedures;

    1.9 Warranty period and procedures (after transfer);

    1.10 Grounds for and effects of contract termination including modes for settling disputes;

    1.11 The manner and procedures for the resolutions of warranty against corruption; and

    1.12 Compliance with all other applicable laws, rules, and regulations.

B. Specific Contractual Arrangement, Term, and Scope of Work

1. No specific contract language is required.

2. However, parties should identify the specific contractual arrangement under which the project is to be undertaken. As proposed in the report, the contractual arrangement to be adopted is the Rehabilitate-Operate-Transfer ("ROT") model, whereby an existing facility is turned over to the contractor to refurbish, operate and maintain for a period, at the expiry of which the legal title to the facility is turned over to the Water District.

3. The definite period of contract duration should be specified.

4. The scope of work should be indicated and for performance-based contract for NRW reduction, the statement of scope of work may include the specific components of: (i) DMA Establishment Works, (ii) Water Loss Reduction and Management Services, and (iii) Pipe Replacement, Meter Installation and Unforeseen Works.

C. Project Technical Specifications and System Features

1. No specific contract language is required.

2. The Revised IRR provides that the contractor shall build the facility in accordance with the design and performance standards and specifications prescribed in the approved detailed engineering design. A preliminary detailed engineering design and plan should be submitted for the approval of the Water District and for incorporation in the contract. The approval of the detailed engineering design and plan by the Water District does not diminish the responsibility of the contractor nor transfer any part of the responsibility to the Water District. (Revised IRR, Section 12.6)

3. It is also useful to note that minimum design and performance standards/specifications ("MPSS"), including appropriate environmental standards, are required to be clearly defined and shall refer more to the desired quantity and quality of the outputs of the facility. Non-conformity with any of the MPSS shall render a bid non-responsive. (Revised IRR, Section 4.3)

D. IMPLEMENTATION MILESTONE

1. No specific contract language or form is required. However, in previously executed BOT Law contracts under the PPP program of the current administration, detailed milestones are provided under a matrix, setting out completion dates. It seems that this is preferred by implementing agencies.

2. Detailed milestones are also preferred considering that the contractor is bound under the Revised IRR to execute the project in accordance with pre-determined milestones. Failure by the contractor to comply with the milestones may result in contract rescission and forfeiture of the performance security of the contractor.

E. COST RECOVERY SCHEME

1. No specific contract language is required. The cost recovery scheme for a BOT Law project may be as approved by the Water District.

2. The Revised IRR, however, provides some guidance on cost recovery mechanisms depending on the type of contractual arrangement (see Revised IRR, Section 12.16.1). For ROT, the contractor may be paid out of reasonable tolls, fees and charges for a fixed term. Where applicable, the contractor may also be repaid in the form of a share in the revenue of the project. (Revised IRR, Section 12.6.1 (a) and (d))

3. The Water District may share in the revenue in the form of either a fixed fee or a certain percentage of the gross revenue or a combination of both, as indicated in the contract. (Revised IRR, Section 12.7)

4. Where investment recovery and related fees are linked to tolls, tariffs, fees and charges by the Water District, the Revised IRR provides:

    4.1 The proposed tariff shall be considered by the Water District in the evaluation of the bid, taking into account the reasonableness thereof to the end-users of the facility and subject to approval of regulatory authority. (Revised IRR, 12.16.2)

    4.2 The tariffs may be subject to adjustment during the life of the contract, based on pre-determined formula and the approved contract. The Revised IRR state that the "[t]he government shall ensure that the project proponent [contractor] recovers the difference between the amount of tolls, fees, rentals and other charges as stipulated or

computed based on the contract or approved parametric formulae and the amount approved by the regulator or appropriate regulatory body through measures consistent with applicable laws and the Constitution."

F. LIQUIDATED DAMAGES

1. No specific contract language is required.

2. Where the contractor fails to complete the work on or before completion date, or as prescribed in the contract, or meet the operating performance standard, the contractor shall pay the Water District liquidated damages as may be specified in the contract as an indemnity and not by way of penalty.

3. The Revised IRR provide that during the construction period, the amount of liquidated damages due for every day of delay beyond the completion date (including extension or grace period) will be determined by the Water District based on the formula in the contract. (Revised IRR, Section 12.14)

4. During the operation period, the amount of liquidated damages, which will be determined by the Water District, shall be based on the principle of fair compensation for damages, which the Water District will sustain as a result of the contractor's failure to meet its obligations. (Revised IRR, Section 12.14)

5. The imposition and collection of liquidated damages shall be without prejudice to the right of the Water District to rescind the contract.

G. PERFORMANCE AND WARRANTY BONDS

1. No specific contract language is required.

2. The contractor is required to post a performance guarantee as performance security during the period of construction. The form and amount shall be provided in the Notice of Award.

3. The Water District shall determine the form of performance security it will require, which may be in cash, bank draft, or guarantee confirmed by a local bank, letter of credit issued by a reputable bank, surety bond callable on demand issued by surety or insurance companies duly accredited by the Insurance Commission, or a combination thereof.

4. The minimum amounts are as follows: (i) for cash, irrevocable letter of credit, bank draft — minimum 2% of the total project cost; (ii) bank guarantee, minimum 5% of total project cost, and (iii) surety bond, minimum 10% of total project cost.

5. The performance guarantee shall be valid up to the acceptance by the Water District of the facility. As may be agreed upon in the contract, a portion of the performance security shall be released upon compliance with corresponding milestones. (Revised IRR, Section 12.13)

6. The Water District is advised to secure performance security for operations, to be submitted on acceptance of the facility. The performance security for operations will be issued to guarantee the proper operation of the project in accordance with the operating parameters and specifications under the contract. The forms for construction period performance guarantee apply. The performance guarantee shall be valid for the period provided in the contract. The performance security shall be released by the Water District on the transfer date of the facility, provided there are no claims filed against the contractor and sub-contractors.

H. Minimum Insurance Coverage As May Be Required

1. No specific contract language is required.

2. The interest of the Water District is required to be insured, provided that the cost of the insurance coverage shall be included in the terms and conditions of the approved contract. (Revised IRR, Section 12.21 (c))

I. Acceptance Tests and Procedures

1. No specific contract language required.

2. It is important to provide for the terms upon which Certificate of Completion and Certificate of Acceptance to be issued. In BOT Law contracts recently concluded and publicly available, test and inspection process provides for costs at the contractor's expense. The Water District and Project Manager (Independent Consultant) are entitled to attend. In the event the test is not passed, the contractor may rectify and shall repeat the test.

3. Under the Revised IRR, the Water District shall issue a Certificate of Completion of the construction works on completion (Section 12.13a) and within a period of no more than one year after its issuance, the Water District shall issue a Certificate of Acceptance upon the final acceptance of the facility.

J. Warranty Period and Procedures (After Transfer to the Water District)

The project proponent shall provide warranty that the facility meets the project technical specifications/agreed system features, performance standards and services in connection therewith for a period not less than one (1) year from the turnover of the facility (Revised IRR, Section 12.23). The contract shall within the contract term and warranty period undertake the necessary and appropriate repair and maintenance of the project, in accordance with the design and performance standards, and other terms prescribed in the contract as approved, in order to ensure that the facility operates at the desired level of service. For this purpose, and where applicable, a portion of the project's revenue equivalent to the cost of the project's repair and maintenance, shall be set aside and reserved exclusively for repair and maintenance costs of the project.

K. Grounds For and Effects of Contract Termination

1. No fault - If the project is (i) revoked, cancelled, or terminated by the Water District in accordance with the contract through no fault of the contractor or by mutual agreement, or (ii) revoked or cancelled by a court by final judgment through no fault of the contractor, the Water District shall compensate the contractor for its actual expenses incurred in the project plus reasonable rate of return (which for a public utility is pegged at 12%), as of the date of the contract termination.

2. Water District default - If the Water District fails to comply with any major obligations under the approved contract, and such failure is not remediable, or if remediable shall remain un-remedied for an unreasonable length of time, the contractor may, with prior notice and specifying the turn-over date, terminate the contract. In such case, the contractor shall be reasonably compensated by the Water District for equivalent or proportionate contract cost.

3. In the above cases, an independent appraiser, mutually acceptable to the Water District and the contractor shall determine the amount to be paid to the contractor. The determination shall be made within 180 calendar days from contract rescission and termination. The amount determined by the independent appraiser shall be binding to both the contractor and Water District.

4. Contractor default - But if it is the contractor which (i) refuses or fails to perform any of the provisions of the contract with such diligence as will ensure the project's completion, operation, and maintenance in accordance with the prescribed technical and performance standards or (ii) otherwise fails to satisfy any of the contract provisions including compliance with milestones, or (iii) commits any substantial breach of the contract, the Water District shall notify the contractor in writing of the same and if not corrected within the time specified, the Water District concerned may rescind the contract and the Water District may: (i) take over the facility; or (ii) allow the lenders/creditors/banks to exercise their rights and interests.

L. Modes for Settling Disputes

1. There is no required contract language or specifically prescribed dispute resolution modes.

2. Executive Order No. 78 promulgated in 2012 prescribes the inclusion of provisions on the use of alternative dispute resolution mechanisms in all contracts involving public-private partnership projects, build-operate and transfer projects, joint venture agreements between the government and private entities and those entered into by local government units.

3. Clauses developed on dispute resolution in other BOT Law contracts provided for a dispute resolution role for the Independent Consultant, the establishment of a dispute resolution board, and resort to binding arbitration.

4. For this type of project, should a Project Manager (Independent Consultant) be appointed, the appointee may be assigned a role in dispute avoidance and management. An escalation from mutual discussion to arbitration administered by the local dispute resolution provider, Philippine Dispute Resolution Center, Inc. should be appropriate.

M. OTHER SIGNIFICANT PROVISIONS,

1. Other provisions as may be appropriate for this contract include those which address financing, if to be obtained by the contractor, government share or subsidy, and securing project site.

2. Contract variation is permissible upon approval by the Water District Board, provided that:

   2.1 there is no impact on the basic parameters, terms and conditions as approved by the NEDA ICC,

   2.2 there is no increase in agreed fees, tolls, and charges or a decrease in the Water District's revenue or profit share derived from the project, except as may be allowed in the parametric formula in the contract; or

   2.3 there is no reduction in the scope of works or performance standards, or fundamental change in the contractual arrangement or extension in contract term (except in cases of breach of part of the Water District); or

   2.4 there is no additional government undertaking or increase in the financial exposure of the government under the project.

III. EXAMPLE TECHNICAL CONTRACT PROVISIONS

A. BASIC CONCEPTS

1. The main objective of this performance-based contract is to reduce leakage in an efficient and sustainable way. The four elements of the contract are:

   1.1 Establishment of District Meter Areas ("DMA Establishment Works"),
   1.2 Water Loss Reduction and Management Services,
   1.3 Installation of new connections for new customers inside the DMA ("System Expansion Works"),
   1.4 Customer Meter Replacement within the DMA, and
   1.5 Emergency works and unforeseen works inside or outside of the DMA network

2. This contract is based on the BOT Law, using the rehabilitate, operate and transfer mode; under which the contractor will take possession of each DMA network, from the boundary valve isolating the DMA up to the customer meter, after the DMA is established and after the DMA Water Loss Baseline measurement has been determined. (The DMAs under control of the contractor are individually and collectively called "the Site")

3. The contractor will finance the project activities: 1) establishment of DMAs and Water Loss Reduction and Management Services, including the capital investments of leak detection and pipe repairs or replacement within the DMAs

4. The contractor will be compensated through a performance fee, paid monthly in arrears, based on a base rate per cubic meter of water saved.

5. The Water District will bear the risks of realizing revenues associated with the water saved.

6. System Expansion Works, Customer Meter Replacement and Emergency Works and other unforeseen works will be done at the direction of and paid by the Water District, with payment to contractor, upon completion of the works, based on unit prices indicated in a Bill of Quantities.

B. DMA ESTABLISHMENT WORKS

1. The contractor will split the network in the Contract Area into DMAs, in accordance with the DMA Design and Establishment Plan. Each DMA will include between 500 and 2,000 service connections.

   The Contractor shall review the DMA Design and Establishment Plan of the Water District and suggest changes if necessary, i.e., if he wants to merge two small DMAs or split too large DMAs. The Contractor will discuss these suggestions with the Water District, and submit a revised Plan for approval. The DMAs to be established shall cover the entire Contract Area but the final number of DMAs will only be established after the revised outline DMA Design and Establishment Plan is approved. The revised outline DMA Design and Establishment Plan shall be submitted as early as possible but latest six (6) months after the contract start date.

2. The Scope of Work for DMA Establishment Works will include:

   2.1 detailed site investigations, updating of distribution network drawings, complete with all trial holes that might be required to verify pipe connections (and the consequent re-instatement of road, sidewalk or any other surface);

   2.2 verification of suggested DMA boundaries; locating of existing boundary valves, functioning and tightness checks of existing boundary valves, identification of location for additional boundary valves to be installed, identification of locations where the pipes will be disconnected and capped);

   2.3 selection of location for DMA inflow chamber; and,

   2.4 identification of customer service connections that have to be re-located from a trunk or distribution main outside the DMA (or in a neighboring DMA) to a distribution main inside the DMA;

   2.5 detailed design of:
   (a) all pipelines that have to be laid,

   (b) location and installation details of new boundaries valves,

   (c) DMA inflow chamber, complete with bypass and valve arrangements, connection to main outside and inside the DMA, all pipework and structural design, pressure reducing valve specifications,

   (d) standard design and map with location of all customer connections to be relocated and,

(e) all other civil, mechanical, installation or plumbing works that might be required.

2.6 submission of the complete detailed design to the Water District for approval;

2.7 construction of inflow chamber, complete with the installation of all pipework, bypass, valves, flow meter and strainer and pressure reducing valve; including supply of all required pipes, materials, fittings and equipment, as per the engineering specifications; note that the contractor and the Water District will agree on a maximum inflow pressure for each DMA, PRVs shall be installed to reduce inflow pressure, as necessary.

2.8 execution of all other civil, mechanical, installation or plumbing works, including supply of all required pipes, materials, fittings and equipment required for DMA establishment, as per the engineering specifications;

2.9 for all works carried out: reinstatement of road and sidewalk surface;

2.10 supply and installation of dual channel pressure and flow data logger at the inflow point, setting up of data transfer to Contractor's office and Water District's office (GSM data transfer); supply and installation of respective software;

2.11 execution of zero-pressure-test and execution of all subsequent investigations and works should the first zero-pressure-test have failed until the test is successfully performed;

2.12 commissioning of PRV, as necessary, and controller; and

2.13 preparation of as-built drawings for all works executed, including those described below, updating of the AutoCAD maps that were provided by the Water District.

3. Based on the DMA Design and Establishment Plan, the contract will include annual targets for establishing DMAs, for example (assuming 40 DMAs will be established):
   - Year 1 – 5
   - Year 2 - 15
   - Year 3 – 25
   - Year 4 – 35
   - Year 5 – 40

4. Liquidated damages will be charged per day for not achieving the DMA establishment target, after a 30-day grace period.

C. WATER LOSS REDUCTION AND MANAGEMENT SERVICES

1. Water Loss Reduction and Management Services are the core element of this contract. The Contractor has to take all necessary action, provide all required services and materials and carry out all works required to achieve the objective of the contract and reduce leakage in the Site. The following list summarizes the activities the Contractor is normally expected to carry out:

    1.1 baseline water loss and pressure measurement prior to starting any activities;

    1.2 leak detection surveys (using all kinds of equipment and technologies, from simple sounding with a listening stick to leak noise correlators and leak noise loggers as appropriate);

    1.3 pressure management: stabilizing, managing and reducing average DMA pressure using PRVs and controllers and various techniques as appropriate;

    1.4 leak repair or replacement of leaking mains, pipes and service connections;

    1.5 final water loss and pressure measurement after the leakage reduction activities have been successful concluded;

    1.6 continuous monitoring of DMA inflow, pressure and minimum night flow and execution of leak detection and repair should the tolerance limits be exceeded;

    1.7 detection of illegal connections and reporting to the Water District, who shall either authorize disconnection or formalize the connection as System Expansion Works

2. The DMA Water Loss Baseline (DWLB) measurement will be determined using the QI - QM method: QI stands for DMA inflow and QM for the metered consumption in the DMA (based on meter reading of all customer meters). Because Water Districts may have intermittent supply in some areas, the following procedure will be used:

    2.1 The Water District shall have the opportunity to identify all customer meters that are likely to under-register (for example suspiciously low monthly customer consumption) and replace them before the DMA Water Loss Baseline Measurement.

2.2 Carry out a 7 day DMA inflow measurement. Flow meter data to be logged with an electronic logger using 5 minutes logging intervals.

2.3 Calculate the average hourly DMA inflow: QI (m3/h).

2.4 During the same period, calculate the DMA average pressure measurement for the baseline (PB), pressure data to be logged with an electronic pressure logger using 5 minutes logging intervals. In the case of small DMAs the inflow pressure is considered to be at a similar level than the average zone pressure. In case of larger DMAs, the Project Manager might order the execution of a pressure measurement at the average pressure location of the DMA.

2.5 Calculate the average baseline pressure, PB (m), over the 7 day period

2.6 Read all customer meters in one day on day 1 of the 7-day period, keeping record of the reading time and on one day on day 7, keeping a record of the reading time. First and second reading of a specific meter should be at approximately the same hour of the day.

2.7 Calculate the total metered consumption of all customers in the DMA and calculate the hourly average QM (m3/h) based on the hours of supply during the 7-day period. In cases where the customer meter was inaccessible during the visit of the meter reader, use a past billing period with two meter readings and calculate the average hourly consumption, based on historical hours of water supply for the same period.

2.8 Calculate baseline leakage: DWLB = QI - QM (m3/h)

3. The Monthly Water Loss (MWL) measurement will be determined using the following methodology:

3.1 Using the recorded DMA inflow data, including hours of supply, calculate the average hourly flow during the month (m3/h).

3.2 Read all customers' meters and record the reading time.

3.3 Using the previous months meter readings, reading times and the hours of supply information during the month, calculate the average hourly consumption during the month (m3/h).

3.4 Calculate the monthly leakage: MWL = Qi – Qm (m3/h)

4. The Water Loss Reduction Achievement (WLRA) in a DMA for the month will be calculated as follows:

WLRA- (DWLB-MWL) x avg. hours of supply per day x the number of days in the month

5. To protect the Contractor from changes in supply beyond his control, the average hours of supply per day for this calculation will not be less than the average hours of supply per day for the Site at the time the baseline is determined.

6. In cases where, the average DMA pressure during the monthly measurement is more than 1 m higher than it was during the baseline measurement, but within the maximum inflow pressure for the DMA agreed between the parties, a special method of calculating the loss reduction achievement per hour (i.e., DWLB-MWL) shall be applied:

   6.1 Express baseline leakage (DWLB) in l/conn/h per m pressure (using average baseline pressure PB and number of service connections), e.g.:

   70 l/conn/h at 7 m pressure = 10 l/conn/h/m

   6.2 Express monthly leakage (MWL) in l/conn/h per m pressure (using average quarterly pressure PQ and number of service connections), e.g.:

   60 l/conn/h at 10 m pressure = 6 l/conn/h/m

   6.3 Calculate leakage reduction achievement per hour (e.g., if DMA has 1,000 connections):

   (10 – 6 = 4 [l/conn/h/m]) x ((7+10)/2=8.5 [m]) = 34 [l/conn/h]
   LR = 34 [l/conn/h] x 1,000 = 34 (m3/h)

7. The contract will include minimum annual targets for water loss reduction, stated in cubic meters per day, using the average hours of supply per day for the Contract Area, stated in the bidding documents. For example, assuming minimum acceptable achievement for the project is to reduce water loss by 40,000 cubic meters per day, the annual targets might be:

   - Year 1 – 2,000
   - Year 2 – 10,000
   - Year 3 – 20,000
   - Year 4 – 40,000

8. Liquidated damages will be charged per day for not achieving the annual water loss reduction targets, after a 30-day grace period.

D. Performance Fee Payment

The contractor will be compensated through the Performance Fee. The Performance Fee will be paid monthly in arrears and calculated by multiplying the Base Fee (included in the contractor's bid) times the Total Monthly Water Savings. The Total Monthly Water Savings will be sum of WLRA for the Site (i.e., in all DMAs). This is illustrated below:

Performance Fee Payment Example

Assumptions:

1. Annual DMA Target: Year 1 = 5 DMAs established
2. Annual Water Loss Reduction (WLR) Target: Year 1 = 2,000 m3 per day
3. DMAs established- Year 1:
    a. DMA 1 – established at the end of month 3
    b. DMA 2 – established at the end of month 5
    c. DMA 3 – established at the end of month 9
    d. DMA 4 – established at the end of month 11
4. Water Loss Reduction Achieved (WLRA) in Month 12 of the year
    a. DMA 1 = 1500 m^3 per day x 31 days = 46,500 m^3
    b. DMA 2 = 1000 m^3 per day x 31 days = 31,000 m^3
    c. DMA 3 = 500 m^3 per day x 31 days = 15,500 m^3
    d. DMA 4 = 100 m^3 per day x 31 days = 3,100 m^3
5. Base Rate 79% of Tariff ($0.50) per m3

Result:

Performance fee for Month 12: (WLRA x Base Rate) 96,100 m^3 x $0.39 = $37,479

Note:

1. A similar calculation would have been done for month 4 through month 11
2. Contractor met Annual Water Loss Reduction Target: 96,100 / 31 = 3,100 m^3
3. As contractor did not meet Annual DMA Target, he would be required to pay liquidated damages until DMA 5 is established, after a 30 day grace period

Annexed to this report is a financial model with a hypothetical example of a performance based contract, using the above cost recovery scheme.

E. SYSTEM EXPANSION WORKS

1. It is expected in many (if not all) DMAs that a few properties can be found that do not yet have a water supply connection. It is of course in the interest of the Water District, that such properties would apply for an account and would get connected. In such cases, it would be the duty of the Contractor to install such new connections and, if necessary, lay additional distribution mains. Unit prices for System Expansion Works will be included in the BOQ price as part of the Contractor's bid.

2. The scope of work includes (but is not limited to):

   2.1 Laying of additional main pipes required to connect new customers; applicable should in a part of the DMA several new customers apply for connections but no main pipe exists in the respective street. The scope includes:
   - Supply and installation of uPVC or Ductile Iron pipelines and all fittings, including connection to the network, including detailed design, sand bedding, testing and disinfection, re-instatement of road, sidewalk or any other surface.

   2.2 Installation for additionally required valves inside the DMA that might be required when a pipeline is laid or when the number and location of existing valves is inappropriate for leakage location purposes (e.g., step-testing). The scope includes:
   - Detailed design, supply and installation of sluice valves, complete with connection to the existing distribution network, complete with all fittings and materials required, including re-instatement of road and sidewalk surface.

   2.3 Installation of service connections for new customers to (previously) existing mains or to new mains laid. The scope of the item includes:
   - Detailed design, supply and installation of customer service connections for new customers, from (and including) the pipe saddle to the point of customer meter installation, complete with all fittings and materials required, including re-instatement of road and sidewalk surface.

3. The Bill of Quantities for System Expansion Works will consist of three items:
   - Laying of additional main pipes required to connect new customers
   - Installation of additionally required valves inside the DMA
   - Installation of service connections for new customers

4. On the basis of a request from the Water District or based on the Contractor's own observations in the DMA, the Contractor shall prepare a map with the location of new customers and the suggested pipeline and/or service connection installation and submit to the Water District for discussion. If the need for system expansion works is confirmed, the Project Manager will instruct the Contractor to prepare detailed design for the respective works. The detailed design shall be submitted to the Project Manager for approval. Based on the approved detailed design, the Project Manager will issue a work order to the Contractor.

F. Customer Meter Replacement

1. On the basis of a request from the Water District or based on the Contractor's own observations in the DMA, the Contractor shall prepare a map with the location of customer meter requiring replacement and submit to the Project Manager for discussion with the Water District. If the need for customer meter replacement is confirmed, the Program Manager will instruct the Contractor to replace the customer meter.

2. Unit prices for replacing meters of varying sizes will be included in the BOQ price as part of the Contractor’s bid.

G. Emergency Works and Unforeseen Works

1. Emergency and Unforeseen Works are leak repair works outside the Site or other plumbing, repair, installation or maintenance works that the Water District might want the Contractor to carry out within the Site, that is not related to the Water Loss Reduction and Management Services. These would typically include leak repairs on trunk mains and distribution mains close to but outside of the DMAs included in this contract. The standard items in the Bill of Quantities cover the following scope of works (and other works might be calculated using elements of the day-work schedule):

   1.1 Supply and installation of uPVC or Ductile Iron pipelines and all fittings, including connection to the network, including detailed design, sand

bedding, testing and disinfection, re-instatement of road, sidewalk or any other surface.

1.2 Detailed design, supply and installation of sluice valves, complete with connection to the existing distribution network, complete with all fittings and materials required, including re-instatement of road and sidewalk surface.

1.3 Disconnection, supply and installation of service connections for customers that were connected to replaced mains, installation of new HDPE service connection from (and including) the pipe saddle to metering point , complete with sand bedding, re-instatement of road, sidewalk or any other surface, including supply of all materials.

1.4 Supply and installation of Fire Hydrant complete with connection to existing main, including all fittings and T-connection, re-instatement of road, sidewalk or any other surface, on main diameter.

1.5 Leak repair on distribution or transmission mains outside the DMAs included in this contract, supply and installation complete with re-instatement of road, sidewalk or any other surface.

1.6 Supply and installation of air valve on main pipe

1.7 Wherever needed, these items also include the preparation of detailed design.

2. The Bill of Quantities for System Expansion Works consists of six items:
   - 2.1 Supply and Installation of main pipelines
   - 2.2 Supply and Installation of sluice valves
   - 2.3 Supply and Installation of Fire Hydrant
   - 2.4 Supply and Installation of customer service connections
   - 2.5 Leak repair on distribution or transmission mains outside the DMAs
   - 2.6 Installation of air valves

IV. TRAINING AND TRANSFER OF TECHNOLOGY

A. SCOPE OF WORK

1. During the Maintenance Period the Contractor shall train the Water District's staff and transfer all technology in order to enable them to take over DMA management, maintenance of pressure reducing valves, leak detection scheduling and execution, leak repair management and all other activities required to manage the DMA system and maintain the reduced leakage levels.

2. The Water District might decide to second leakage management and reduction staff to work jointly with the Contractor's staff on a daily basis. The Water District will continue to pay salaries of seconded staff but the contractor may pay incentive bonuses that are in accordance with bonuses paid to his own staff. Seconded staff shall follow the Contractor's instructions and shall work as part of the Contractor's team. If the Contractor is unsatisfied with the performance of a seconded staff member, he shall inform the Water District. If the unsatisfactory situation continues the Contractor is allowed to reject further secondment of the individual concerned and the Water District may nominate a replacement.

3. As part of the transfer of technology activities the Contractor shall jointly with the Water District's staff develop a medium term asset management strategy that is based on the findings and experience made during the duration of the contract. Strategy development shall be based on updated maps and pipe condition information, detailed burst records and all other information the contractor has collected in the course of the project. All this detailed background information shall be submitted to the Water District, either as part of the continuous reporting or, any additional information, together with the asset management strategy.

B. APPROVAL

1. At the end of the Leakage Reduction Phase the Contractor shall submit a detailed Training and Transfer of Technology program that shall be based on the respective section of the Contractor's Technical Proposal but shall also take the experience into account that was made in the course of the contract. The Program shall be approved by the Water District.

C. COST

1. All activities in respect to training, transfer of technology and development of the asset management strategy are included in the performance fee for leakage management services.

V. SAMPLE TECHNICAL SPECIFICATIONS FOR EQUIPMENT AND MATERIALS

A. GENERAL

1. Contractors have to include detailed information on all proposed equipment and materials in their bid. All proposed equipment and materials have to be in accordance with the specifications below or equivalent international standard.

2. All miscellaneous equipment and materials not listed hereunder shall be of similarly high quality.

3. Should the contractor want to use other equipment/materials than the ones included in the bid, such equipment/materials must also meet the minimum specifications below and may only be used subject to the approval of the Water District.

B. PIPES

1. Main Pipes
   1.1 Ductile Iron Pipes
      (a) Pipes in accordance with [ISO 2531-1988-K9 PN10]
      (b) Sulphate resistant blast furnace cement lining as per [ISO 4179-2005]
      (c) Outside corrosion protection: zinc layer and bituminous coating, as per [ISO 8179-2004]
      (d) Rubber joints in accordance with [ISO 4633-2002]
      (e) Automatic flexible push in joints [TYTON] or [STANDARD]

2. uPVC Pipes
   2.1 According to AS/NZS 1477-1996 PN12, table 4.3 series 2
   2.2 Outer diameter 121.9 mm and 177.3 mm
   2.3 Rubber joints according to AS 1646-1992
   2.4 Color: blue
   2.5 Name of producer, type, pressure and production date shall be marked on every pipe; if pipes are specifically manufactured for this project the word Water District shall be added to the other information

3. Service Connections

3.1 High-Density Polyethylene (HDPE) Pipes shall be according to ISO 4427-1996, in coils of 100 m, and shall be suitable and approved for the use with potable water at a working pressure of min. PN 10.

3.2 The pipes shall be resistant against UV-radiation and shall have black color with 4 blue longitudinal stripes to indicate the application. Name of producer, type, pressure and production date shall be marked on every pipe.

C. PIPE FITTINGS AND APPURTENANCES

1. Flanges of all valves and other appurtenances supplied under this project shall be drilled according to ISO 7005-2-1988 PN 10.

2. All bolts, nuts and washers used under this project shall be stainless steel 304.

3. Valves

3.1 Resilient seated gate valves shall be in general according to ISO 7259-1988, double flanged if not otherwise required; with face to face dimensions to EN 558-1 GR 14-short (DIN 3202-F4) and flange dimensions and drilling to ISO 7005-2-1988 PN 10 and shall be suitable for a nominal working pressure of 10 bar.

3.2 Body and bonnet shall be of ductile iron EN-GJS-400-18 acc. to EN 1563 (GGG 400 - DIN 1693) and shall be inside and outside epoxy powder coated with a minimum coating thickness (DFT) of 250 µm in accordance to DIN 30677-2 and DIN 3476.

3.3 The wedge shall be of ductile iron EN-GJS-400-18 acc. to EN 1563 (GGG 400 - DIN 1693), fully vulcanized with EPDM or NBR (suitable and approved for potable water), with drain hole and special wedge guiding system with high gliding features to guarantee low operation torques. Wedge nut shall be of bronze and flexibly fixed in the rubberized wedge.

3.4 Spindle shall be of the non-rising type and shall be made of stainless steel 304 (X20Cr13) with a rolled thread and shall be polished in the sealing areas. Sealing shall be of the multiple O-ring sealing system. O-rings shall be embedded in non-corrosive material to DIN 3547. Valves from DN 250 mm upwards shall have additionally axial roller bearings in the bonnet to reduce operation torques.

3.5 All bolts/nuts shall be additionally sealed to avoid corrosion. Sealing gaskets between body and bonnet shall be embedded in the casting. An additional spindle sealing gasket shall be placed at the top of the bonnet to protect the spindle against friction due to dust and soil from outside.

3.6 All resilient seated gate valves that will be used for underground installation and shall be supplied, with extension spindle consisting of galvanized steel rod, spindle adaptor and operating cap and protecting tube of plastic material.

4. Pipe saddles

4.1 Pipe saddles for non-metallic pipes

(a) Pipe saddles for use on plastic pipes shall be of the full collar type with a minimum length of 120 mm to support the plastic pipe and with a fully rubber lined sealing area around the full circle with multiple O-rings or multiple lip seals around the outlet.

(b) The outlet of the saddle shall be female thread and specially protected either by a rubber ring or by a special coating to avoid corrosion and incrustation on the blank thread.

(c) The body of the pipe saddle shall be made from ductile iron EN-GJS-400-15 acc. to EN 1563 (GGG 400 DIN 1693) for a nominal working pressure of 10 bar and shall be inside and outside epoxy powder coated with a minimum coating thickness (DFT) of 250 µm in accordance to DIN 30677-2 and DIN 3476.

(d) Stud bolts with nuts and washers and shall be made of stainless steel 304, gaskets shall be of EPDM or NBR (suitable and approved for potable water.

4.2 Pipe saddles for metallic pipes

(a) Pipe saddles shall be of the universal type with flexible strap for DI, steel and AC pipes and shall be suitable and approved for the use with potable water at a nominal working pressure of 10 bar.

(b) The outlet of the saddle shall be female thread and specially protected either by a rubber ring or by a special coating to avoid corrosion and incrustation on the blank thread.

(c) The body of the pipe saddle shall be of ductile iron EN-GJS-400-18 acc. to EN 1563 (GGG 400 DIN 1693), inside and outside epoxy powder coated with a minimum coating thickness (DFT) of 250 µm in accordance to DIN 30677-2 and DIN 3476.

(d) Saddle strap and bolts/nuts/washers shall be made of stainless steel 304. Strap shall be rubber lined to avoid direct contact between the stainless steel strap and the pipe. Gaskets shall be of EPDM or NBR (suitable and approved for potable water).

5. Fittings for HDPE Service Connections

5.1 Pipe Fittings

(a) Pipes fittings for the use on HDPE pipes according to DIN 8074/8075 (or equivalent) shall be push-in type and shall be fully traction prove and tight at a nominal working pressure of 10 bar.

(b) Body shall be either of brass, Polypropylene (PP) or UV-resistant Polyoxymethylene (POM), grip ring shall be of Polyacetale; in case of bodies made from plastic material, female threads shall be enforced by stainless steel support rings.

(c) Sealing shall be done by an O-ring made from EPDM or NBR (suitable and approved for potable water).

(d) The design of the fittings shall allow an easy installation and dismantling. Versions shall be available as both, straight and 90° bend female and male adaptors and couplers as well as T-pieces.

5.2 Corporation Stops

(a) Corporation stops shall be of the ball type or ground key type.

(b) Inlet threads shall be fully compatible with the tapping saddle threads.

(c) For ¾ in and 1 in corporation stops the outlet shall be a flare nut connection for High-Density polyethylene (HDPE) pipe, fully compatible with the HDPE pipe specified herein.

(d) For 1 ½ in corporation stops, the outlet shall be a pack joint compression connection for High-Density polyethylene (HDPE) pipe, fully compatible with the HDPE pipe specified herein.

(e) The corporation stops, pack joints and flare nuts shall be designed for 10 bars water pressure.

(f) The waterway diameter shall be equal to the nominal size of the corporation stop.

(g) All cast components shall be of brass conforming to ASTM B62.

(h) The ball of Ball Design corporation stops shall rotate between two rubber seats. Rubber shall be Buna-N or equivalent rubber

conforming to ASTM D2000.The operating nut shall have an O-ring to provide a watertight seal against the body. The O-ring shall be of EPDM or an equivalent rubber conforming to ASTM D2000.

(i) The key and body of Ground Key Design corporation stops shall be lapped and ground together to assure seating surfaces match.

(j) The flare nut and the valve outlet end shall have machined sealing surfaces that provide a permanent watertight seal on properly flared HDPE pipe.

(k) The pack joint connection shall consist of a threaded sleeve, a threaded nut and a rubber gasket. The design shall provide proper gasket compression against the HDPE pipe to make a watertight connection. The pack joint nut shall have a clamp device to assist axial restraint of the HDPE pipe.

(l) One insert stiffener complying with the requirements shall be supplied with each corporation stop equipped with a pack joint connection.

(m) All threads shall be capped for protection during shipment and handling.

5.3 Angle meter valves

(a) Angle meter valves shall be of the ball type.

(b) For ¾ in and 1 in angle meter valves, the inlet shall be a flare nut connection for High-Density polyethylene (HDPE) pipe and the outlet shall be a meter swivel nut threaded in accordance with ISO 228-1.

(c) For 1 ½ in angle meter valves, the inlet shall be a pack joint compression connection for High-Density polyethylene (HDPE) pipe and the outlet shall be a meter flange.

(d) The angle valves, pack joint or flare nut inlet connections and swivel nut or meter flange outlet connections shall be designed for 10 bars water service.

(e) All cast components shall be of brass conforming to ASTM B62.

(f) The ball shall rotate between two rubber seats. Rubber shall be Buna-N or equivalent rubber conforming to ASTM D2000.

(g) The operating head shall rotate over 90 degrees for opening or closing the valve. The operating head shall have two O-rings to

provide a watertight seal against the body. The O-rings shall be of EPDM or an equivalent rubber conforming to ASTM D2000.

(h) The flare nut and the valve inlet end shall have machined sealing surfaces that provide a permanent watertight seal on properly flared HDPE pipe.

(i) The pack joint connection shall consist of a threaded sleeve, a threaded nut and a rubber gasket. The design shall provide proper gasket compression against the HDPE pipe to make a watertight connection. The pack joint nut shall have a clamp device to assist axial restraint of the HDPE pipe.

(j) Angle valves shall have padlock wings to lock the valve in the closed position.

(k) One insert stiffener complying with the requirements shall be supplied with each angle valve equipped with a pack joint connection.

6. Fire Hydrants

6.1 Fire hydrants shall be of the dry - barrel type and shall conform to [Philippine SPECIFICATION] and as further specified herein.

6.2 Fire hydrants shall be of "Traffic Model" with breakable sections near the ground line designed to break upon impact, complete with safety flanges and steel stem coupling.

6.3 Unless otherwise specified materials shall comply with the following requirements.

(a) Cast iron shall conform to ASTM A 126 Class B.
(b) Ductile iron shall conform to ASTM A 536 Grade 65-45-12.
(c) Bronze shall conform to ASTM B 62, Grade D or E.
(d) Stainless steel shall conform to ASTM A 276, Type 304 or Type 316, or Type 420 for non-wetted parts.

7. Ductile Iron Fittings

7.1 Ductile Iron fittings shall be in accordance with ISO 2531-1998, they shall be inside and outside epoxy powder coated with a minimum coating thickness (DFT) of 250 µm in accordance with DIN 30677-2 and DIN 3476.

7.2 All gaskets shall be of EPDM rubber according to ISO 4633-2002.

8. Universal Joints DN 50 – 300 mm
   - Flanges shall be to ISO 7005-2-1988 PN 10; Gaskets shall be of EPDM or NBR (suitable and approved for potable water).

9. Universal Couplings
   9.1 Universal couplings shall be of the wide range type and shall be suitable for the use with steel pipes, cast iron pipes, ductile iron pipes, asbestos cement pipes and UPVC pipes for a nominal working pressure of 10 bar.

   9.2 Pressure ring and body shall be of ductile iron EN-GJS-400-18 acc. to EN 1563 (GGG 400 DIN 1693) or forged steel, and shall be inside and outside epoxy powder coated with a minimum coating thickness (DFT) of 250 µm in accordance to DIN 30677-2 and DIN 3476.

   9.3 The design of the couplings shall allow a total angular deflection of the pipe of minimum +/- 6 degrees and an axial translation of the pipe of minimum 10 mm.

10. Universal Flange Adaptors
   10.1 Universal Flange Adaptors shall be of the wide range type and shall be suitable for the use with steel pipes, cast iron pipes, ductile iron pipes, asbestos cement pipes and UPVC pipes for a nominal working pressure of 10 bar.

   10.2 Pressure ring and body shall be of ductile iron EN-GJS-400-18 acc. to EN 1563 (GGG 400 DIN 1693) or forged steel, and shall be inside and outside epoxy powder coated with a minimum coating thickness (DFT) of 250 µm in accordance to DIN 30677-2 and DIN 3476.

   10.3 The design of the flange adaptor shall allow a total angular deflection of the pipe of minimum +/- 3 degrees and an axial translation of the pipe of minimum 5 mm.

11. Couplings and Flange Adaptors > DN 300 mm
   - Couplings and flange adaptors for dimensions bigger than DN 300 mm shall be of ductile iron EN-GJS-400-18 acc. to EN 1563 (GGG 400 DIN 1693) or rolled/forged steel, and shall be inside and outside epoxy powder coated with a minimum coating thickness (DFT) of 250 µm in accordance to DIN 30677-2 and DIN 3476.

12. Repair clamps
   12.1 Pipe repair clamps shall be of the full circle universal type, suitable for CI, DI, steel, AC and PVC pipes.

12.2 All metallic parts like band, lugs, bolts, nuts and amour shall be of stainless steel 304, specially treated (passivated) after welding to avoid corrosion. Bolt threads or nuts shall be additionally coated to avoid high friction when tightening. The gasket shall be of EPDM or NBR (suitable and approved for potable water) and shall be of the waffle design and with a vulcanized amour at the overlapping area.

D. DMA INFLOW METERING

1. Installations in for the DMA inflow chambers shall be in accordance with Drawing D-02 (see Section X - Drawings). The chamber and all pipe installations will have to be re-designed by the Operator depending on size and specification of PRV and flow meter. Attention is to be paid on required undisturbed flow before and after the meter as per the manufacturer's recommendations.

2. DMA inflow meters

2.1 The Contractor shall follow the [APPLICABLE STANDARDS].

2.2 DMA inflow meters shall be in accordance with ISO 9104-1991.

2.3 Electromagnetic flow meters with an accuracy of +/- 0.5% or better and the ability to accurately measure extremely low off-peak flow rates.

2.4 The flow metering system shall include the facility to verify correct operation of the flow-meter by comparison of on-site verification test characteristics with original factory characteristics and calibration settings.

2.5 The flow sensor shall be constructed from 304 stainless steel, with an elastomer lining, or equivalent to suit operating conditions. The flow sensor shall be rated IP68 to 5m suitable to be permanently immersed, or to be buried.

(a) Flanges shall be to ISO 7005-2-1988 PN 10.
(b) Measuring electrodes shall be of 316 stainless steel.
(b) Earthing electrodes or external earthing rings shall be provided with the flow sensor.

2.6 The flow sensor cabling shall be of a nominated length and shall be produced at the factory. The cabling shall be potted at the flow tube with a re-enterable mix or an equivalent system to maintain the IP68 to 5m submersion or burial capability.

2.7 Meters shall be equipped with battery packs that are sufficient to provide power for measurement and transmission of flow data for a minimum period of 5 years with a low battery power indicator.

2.8 A remote display unit that shows for flow rate and totalized flow, this unit will be mounted in an above ground equipment box. The totalized flow value shall be retained through battery power failures. Adjustment for tantalizer cut off shall be provided.

2.9 Output signals: Frequency - two bi-directional solid state transistor switches, Isolated from process, Used for forward and reverse flows.

2.10 The transmitter housing shall offer a minimum of IP65 protection. It shall be rated for operation at ambient temperatures up to 50 degrees Celsius.

3. Strainers

3.1 Strainers shall be inside and outside epoxy powder coated with a minimum coating thickness (DFT) of 250 µm in accordance with DIN 30677-2 and DIN 3476. All other metal parts shall be stainless steel.

E. PRESSURE REDUCTION EQUIPMENT

1. Pressure reducing valves (PRV)

1.1 The selection of pressure reducing valves will be one of the most important and technically most difficult decisions to be made. The extremely low day-time pressures (often between 5 and less than 10 meters) are a major challenge for pressure reducing valve requirements.

1.2 The Contractor might provide specifications from more than one manufacturer if he wishes to do so. However, all pressure reducing valves proposed must strictly meet the following minimum requirements:

(a) Main Valve Heat Fusion Epoxy Coated, externally and internally (not painted)
(b) Main Valve shall have Stainless Steel Seat Ring
(c) Valves shall have stainless steel stems. Stem less Main valves are not permitted.
(d) All external fasteners and washers shall be stainless steel 18/8 or better
(e) Pilot circuit isolation valves for inlet, outlet and valve head isolation
(f) Pilot system shall have some form of opening speed control. Closing speed controls shall be optional.

(g) Pressure gauges shall be supplied that will be installed about two diameters upstream and downstream of the PRV
(h) Equipped with air valves to automatically bleed off air that may become trapped in the valve head during a water supply interruption
(i) Pilot system must be able to work with most industry standard controllers; necessary adaptors must be provided if required
(j) Each valve shall be supplied with a variety of springs, taking the extremely low pressure situation into account
(k) Valve flanges shall be drilled according to ISO 7005-2-1988 PN 10.
(l) Supplied complete with stainless steel bolts, washers and nuts and gaskets which shall be of EPDM rubber according to ISO 4633-2002.
(m) Three year warranty for valve to be free of defects in material and workmanship (from the date of shipment)
(n) PRVs must have either NSF (American, http://www.nsf.org/) or WRAS (UK, http://www.wras.co.uk/) or other substantially equivalent internationally accepted certificate (such as Japan, Europe, etc.). All supporting documents must be included in the bid.
(o) Manufacturer must be able to provide support and maintenance services in [LOCATION]. In case a manufacturer is not doing business within Philippine, the Contractor should ensure that the concerned manufacturer, before contract signing or an appropriate timing as agreed with the Water District, will arrange a representative Agent in the country equipped and able to carry out the maintenance, support, repair and stocking obligations prescribed in the Conditions of Contract and/or Technical Specifications.

1.3 Contractor to supply a reasonable number (to be agreed with the Project Manager) of valve repair kits containing all internal valve and pilot parts for the various valve types and diameters at the end of the Maintenance Period.

2. PRV controllers

2.1 Although the DMAs are relatively small in size and fixed outlet PRVs might be sufficient in many cases, the contractor is encouraged to experiment with various controllers to get optimum results and also cater for fire-fighting requirements.

2.2 Since it will be in the interest of the Contractor to use only best quality industry standard controllers, the specifications hereunder are kept to a minimum:

(a) controller to be easily retro fitted to any pressure reducing valve to convert the valve from a fixed regime to advance control.

(b) units to be fully sealed to IP68 standards, the pressure connections to be of quick-fit type.

(c) controller to be powered by a fully sealed internal battery, with an expected operational life of 5 years and with low power indicator.

F. FLOW AND PRESSURE DATA LOGGERS

1. All DMA inflow chambers shall be equipped with electronic flow and dual channel pressure loggers, 0-10 bar pressure range, so that the pressure before and after the PRV can be simultaneously measured.

2. The data logger shall be supplied with minimum standard of four inputs for monitoring any combination of digital or analogue signals.

   2.1 Digital – Uni or bi-directional pulse. Suitable for reed switch (non-powered sensors) or Instrument powered, e.g., PD4, PD100, Kent, HRP, etc.

   2.2 Analogue – Pressure Transducers 0-10bar. 4-20mA from isolated sensors.

3. The data logger shall be a GSM/SMS combination to give the benefits of SMS for daily polling of data with four hours of GSM standby window for real-time call back.

4. The logger shall be completely waterproof and submersible to IP68 standards.

5. The data logger shall be powered by an internal fully sealed battery with a minimum operational life of 5 years and low battery alarm in data packet when downloaded.

6. The system shall be capable of being telemetry linked by using cellular communications network with an internal GSM/SMS modem.

7. Data loggers shall also be capable of being interrogated in the field via a comms cable link to a laptop computer, PC, PDA, etc.

8. The GSM/SMS communications shall have the option to enable the logger to "Alarm Out" - i.e., the logger shall be capable of being programmed to dial out to preset telephone numbers (landline or cellular) when alarm conditions are recorded (e.g., when pressures or flows exceed upper of lower limits).

G. ABOVE GROUND INSTRUMENTATION BOX

The contractor shall design above ground mounting boxes in suitable size to house all equipment (like data logger, flow meter display, PRV controller, battery packs) and robust enough to withstand acts of vandalism. Design in principle shall follow the standard Water District design.

VI. SAMPLE TECHNICAL SPECIFICATIONS FOR INSTALLATION AND REPAIR WORKS

A. GENERAL

1. The list below is a non-exhaustive list given the diversity and complexity of the project.

2. Wherever no specific works and installation specifications are listed below, Water District's internal specifications shall be followed.

3. The Contractor is furthermore expected to execute all works in accordance with international best practice and of course in accordance with all relevant Philippine regulations and norms.

4. The Contractor is required to take digital photos of all stages of the work progress. Detailed instructions will be given by the Water District.

5. All old pipes, valves and other appurtenances shall be returned to the Water District unless otherwise instructed thereby.

B. EARTHWORK

1. General

1.1 Scope of this section- The section specifies the requirements for the following:

- Exploratory pits and trial holes
- Cutting road and sidewalk surfaces, trench excavation for pipe-laying, and excavation for construction of concrete structures,
- Disposal of surplus spoil from excavations
- Bedding preparation and installation,
- Backfilling and compaction
- Trimming and final clearing up, reinstatement of surfaces

1.2 Submittals

(a) Surveyed ground levels, location of services and results of site trial excavations for each street, at least 21 days before planned start of excavation work.

(b) Detailed program of work together with method statements and proposed procedures at least 28 days before proposed initial work start date.

(c) Detailed of proposed pipeline bedding and backfilling materials and methods of installation at least 28 days before the proposed start date.

(d) Detailed of methods for trenching and excavation shoring at least 28 days before the intended start date of the work.

(e) For the works the method of working shall be submitted for approval more than 14 days before commencement of the work.

(f) The above submittals are neither required for leak repair works nor the replacement of leaking service connections. Only a schedule of the planned works has to be submitted in accordance with the provisions in TSP Part I.

1.3 Quality Assurance

(a) Investigations and Execution of Pits

- Prepare site investigation details and excavate exploratory pits at least two weeks in advance to establish and prepare details of existing services as specified.

(b) Inspections During Execution of Earthworks

- Excavations may proceed only with the Project Manager's approval of the setting out the original ground level record.
- When Excavation has been carried out to the lines and levels required, the Contractor will notify the Project Manager that inspection is required.

(c) Quality Control Testing

- The following quality control testing is required on the various materials before and during execution of the works:
  - Standard Proctor Compaction Tests
  - Sieve Analyses including hydrometer tests
  - Field densities
  - Atterberg Limits
- As many tests as necessary shall be carried out by the Contractor to ensure the Work conforms to the specifications regardless of any minimum stated.

- Provide typical moisture versus density curves for each type and source of material that is to be compacted to a specified density
- Provident field density test results on the following basis:
- Imported Material for bedding and backfilling of Pipe Zone: every 100m of trench.
- Trench backfill: every 100m of trench for each 0.20m depth of fill.

1.4 Program

(a) The Contractor shall prepare and provide detailed programs for the Project Manager's approval.

(b) Indicate sequence and method of working, and include but not limited to the following for each street:

- Procedure and timing of stages to obtain permission to work,
- Inspection of the site, including necessary exploratory pits to establish location of services and trial holes at the Contractor's expense to establish the suitability of soil as backfilling material,
- Existing ground levels,
- Preparation and confirmation of working drawings for execution of the works,
- Setting out the works'
- Cutting of asphalt, concrete or other surfaces,
- Trench excavation, including shoring,
- Disposal of surplus materials off site,
- Bedding and laying and jointing of pipeline,
- Backfilling after pipe laying, and
- Reinstatement.
- Excavation

(c) Excavation work may proceed in accordance with the program only after receipt of the Project Manager approval.

(d) The above procedure is neither required for leak repair works nor the replacement of leaking service connections. Only a schedule of the planned works has to be submitted in accordance with the provisions.

1.5 Records

(a) All leak repairs, and the replacement of leaking service connections, have to be recorded on a standard leak report sheet that will be provided by CLIENT. The other instructions under 2.1.5 are for other pipe laying works.

(b) Levels

- The contractor shall take and record levels and dimensions as follows:
- Before the surface of any part of the Site is excavated or the works thereon has begun, and,
- As and when necessary during the progress of the excavation to allow accurate measurement of the different categories of excavation.
- Taking and recording all levels and dimension shall be done in an approved manner and in the presence of the Project Manager.
- All such levels and measurements, when approved by the Project Manager shall form the basis for measurement.

(c) Quality Control Tests

- The Contractor shall carefully record all the soil density compaction and other test results.

1.6 Contractor's Responsibilities

(a) The Contractor's contractual responsibilities include responsibilities for the stability of excavations and for the application of shoring or other appropriate means to support the sides of excavations where necessary, in order to:

(b) Maintain the safety and stability of property and structures adjacent to the trench excavation.

(c) Ensure the safety of the personnel working in the trench for the purposes of bedding, pipe laying and compaction of bedding and backfilling materials.

(d) Ensure that the pipe laying work is carried out in stable ground conditions.

2. Bedding and Backfilling Materials

2.1 Except where otherwise directed, all bedding and backfilling, pipeline bedding and backfill materials of pipe zone, above pipe zone, service connection trench and around structures shall be as sand defined in the following table.

Material	a) Clean, firm, nature sand or quarry waste with the following grading: Sieve Size Percent Passing 10mm ..... 100 5mm ..... 60-100 2mm ..... 30-90 0.4mm ..... 8-50 80µm ..... 0-5 b) where shown on the Drawings or directed: Concrete M-150
Compaction Values Required	Average of all values taken shall exceed 95% normal standard Proctor, and no result shall be less than 92%.

2.2 Excavated material that is not suitable for use as backfilling as defined above shall not be re-used and shall be disposed of offsite.

3. Excavation and backfilling

3.1 Excavation

(a) General

- Excavation shall achieve the lines levels gradients and dimensions shown on drawings or as otherwise directed.
- Excavations at foundation level shall be carried out carefully, and all precautions taken to ensure that the bearing capacity of the formation is not disturbed. Excess excavation shall be backfilled as below.
- Repair of any damage to the works or to approved formation caused by the Contractor's excavation operations or negligence of the requirements will be at the Contractor's expense.

3.2 Pipeline Trenches

(a) Trench Width

- Trench dimensions and width shall be sufficient to install the various pipes, specials, closures, fittings, valve chambers, and anchorages, as shown on the Drawings and specified herein.
- The width at the top of the trench shall be not more than the outside diameter of the pipe plus 300mm, or 400mm, whichever is the larger.

(b) Start of Excavation

- Where a trench is excavated in a paved surface, whether of asphalt, concrete, or other material, the Contractor shall start by carefully cutting through the paved surface and foundation

along the lines of the trench, without loosening or damaging the adjacent parts.

(c) Trench Cross Section

- The trench sides shall be excavated as follows unless specifically varied by the Project Manager:
  - With stable soil conditions: vertical sides.
  - With soil of low stability: the excavation faces shall be supported by shoring or sheet piling. Additional trench width shall be included to allow proper tamping of backfill and the placing or removal of piles or shoring.
  - Trench depth shall permit the pipe to be laid to the gradients and elevations shown on the Drawings.
  - At pipe joints, additional excavation shall be made for the pipe joints.

(d) Length of Trench Left Open

- The trench open ahead of pipe laying operations shall be limited to the length of pipe which can be laid in one day except as otherwise authorized by the Project Manager.
- If, natural or artificial conditions create hazardous operations in the performance of excavation, the Project Manager may specify further limitation in the length of open trench permitted.

(e) Disposal of Excavated Materials

- General
  - All excavated materials shall be piled in such a manner not to endanger the work or any buildings, structures or property or obstruct roads pavements and driveways or cause obstruction to traffic.
  - Surplus excavated materials shall be disposed off site to locations arranged by the Contractor, to the general approval of the Project Manager and relevant authorities, and shall not cause any obstruction or interference with the natural drainage of the land.
- Excavated Materials for Reuse
  - When excavated sandy material suitable for re-use, a portion of the excavated material may be used for backfilling.
  - The Contractor shall make his own arrangements for the temporary storage of the suitable excavated materials, and for the permanent disposal off side of surplus materials.

- After completion of pipe-laying the Contractor shall return suitable selected materials for backfilling and dispose of surplus off site.

(f) Structures

- The surface of the formation shall be cleaned of all loose material and be free from standing for running water.
- The concrete blinding layer for structures shall be placed as soon as possible after the completion of the final 500mm of the excavation to formation level, and in any case within 72 hours.
- Excavations shall be to the limits and grades shown in the Drawings to receive all structures, fittings and appurtenances. Excavations shall be to dimensions of the outside surfaces of said structures plus a minimum of 600mm in addition to provision for shaping, and dewatering as specified herein or ordered by the Project Manager.

(g) Excess Excavation

- Excess excavation below the designated formation leveling otherwise sound material shall be backfilled at the Contractor's cost as follow:
- For the pipe trenches fill with concrete or the pipe bedding or other material that the Project Manager may direct.
- For structure foundation fill with [Class M-150] concrete to the correct level

(h) Shoring

- Extent and Installation
  - Excavations shall be shored where ground conditions are such that the stability or safety of adjacent structures or properties would be compromised.
  - The Contractor shall submit his detailed designs and proposed method of installation and remove of shoring to the Project Manager for consideration and approval. The proposals shall show but not be limited to:
    - ❖ The extent of excavation or length of pipeline trench to be shored
    - ❖ The proposed type, material, section, framing and bracing,
    - ❖ Method of installation and removal of the shoring, and
    - ❖ How the safety of the work and wok-men is ensured.
  - The Project Manager's approval does not relieve the Contractor of responsibility for the adequacy of shoring and bracing.

- Removal of Shoring
  - Shoring shall be removed as backfilling proceeds and material thoroughly compacted into the space left by the shoring and supports as they are withdrawn

3.3 Backfilling

(a) Backfilling shall confirm with requirements of the DCTPW regulations. Backfilling shall proceed only when the pipeline or other installation has been completed, tested and required and approved by the Project Manager. Work covered up without such approval shall be exposed to view following the Project Manager's instruction, at the Contractor's cost and expense.

(b) Materials shall be as specified

(c) The Contractor shall allow for settlement to occur and shall make up and repair the temporary surface reinstatement as necessary, to the satisfaction of the Project Manager, until the final reinstatement has been executed.

(d) Backfilling around structures shall start only after concrete has reached a satisfactory strength and only 14 days after concreting except directed or approved by the Project Manager.

3.4 Compaction

(a) Plant and Equipment
- Mechanical tampers with flattened feet shall be used to properly com pact the materials under, on each side and over the pipelines.
- Rolling methods may also be used subject to adequate cover having been achieved over the pipeline and with the approval of the project Manager.

(b) Thickness of Layers
- Backfill shall be placed and compacted in layers of maximum 200mm thick. Where special care is required to achieve maximum compaction, each layer shall be maximum 150 thick.

(c) Moisture Content
- Before and during compaction, the materials shall have moisture content close to the optimum for obtaining maximum compaction of the material as determined by site trials on the materials.

(d) Minimum Density after compaction
- Each layer material shall be compacted achieve test results as specified.
- The Contractor shall carry out quality control tests as defined.

3.5 Reinstatement of surfaces

(a) Temporary Reinstatement

- After backfilling the pipeline trench up to the level shown on the Drawings or as directed by the Project Manager, the Contractor shall install and compact temporary road surface reinstatement.
- To accommodate settlement, temporary surface materials shall be to the same standard as the road.
- The Contractor shall maintain the reinstatement and top restore additional material as necessary, to accommodate settlement for a period of not less than two months

(b) Permanent Reinstatement

- Permanent reinstatement of roads and pavements shall restore them to their original condition.
- The permanent reinstatement shall be carried out by Contractors who have the specific approval of the Roads Department, and shall be carried out by the said subcontractor to the standards and requirements and under the supervision and control of the Department.

C. PIPELINE INSTALLATION

1. General

1.1 Scope of this Section

(a) The collection of pipes and materials provided by the Contractor, and delivery to temporary stores ready for installation.

(b) Installation, jointing, testing and setting to work of pipelines, valves and fittings and making of service connections, using as many full time installation teams as necessary for the completion of the works within the required period.

1.2 Work Not Included in this Section

(a) Earth works, trench excavation, pipe bedding and backfilling.

(b) Trench shoring.

(c) Construction of chambers and thrust blocks.

1.3 Related Sections

(a) General Requirements

(b) Earthworks and Surface Restoration

2. Submittals

2.1 Method Statements

(a) Generic method statements for leak repair works and replacement of leaking service connections and detailed method statements shall be submitted for the review and approval of the Project Manager not less than two weeks before work starts on site.

(b) The statements shall show:

- Procedures for obtaining permission to open roads, site investigations and procedures, and matters related to earthworks and excavation and reinstatement.
- Proposed procedures for identifying and obtaining the necessary materials and fittings provided by the Contractor,
- Transportation and temporary storage arrangements of the materials at the work sites
- How the work is proposed under various site, surface, traffic and ground conditions, together with explanatory sketches, drawings, and supporting the documents,
- Details of all precautionary methods proposed to prevent the pipes from moving at any stage during installation, whether due to flotation or any other cause.
- Hydraulic testing and sterilization arrangements on completion.

2.3 Quality Control

(a) Quality control proposals for meeting the requirements of the Specification.

(b) Program

- Overall program showing requisition, delivery to site, installation, testing and completion program to match the contractual program, and showing the number of sections and number of full time working crew that will be operating concurrently.
- Weekly program for the following two weeks throughout the course of the work, to show all matters related to the installation program, showing each street that is in process of permission to work, site investigations, requisition, and delivery of pipes and fitting, installation, construction, testing and sterilization.

3. Pipe and Materials Requisition and Storage

3.1 Materials Provided by the Contractor

(a) The Contractor shall be responsible for the provision of all materials, plant, equipment and labor required for the construction works, including but not limited to the provision and installation of temporary works of all sorts needed for the installation, cleaning, flushing, sterilization, finishing and completion of the pipelines in accordance with the Specifications, except for the materials, pipes, fittings, valves and appurtenances provided by the Contractor.

(b) For ductile iron pipes, the materials provided by the Contractor shall include, but not be limited to:

- Approved quick setting epoxy paint for application to pipe cut ends,
- Coal tar epoxy paint to repair exterior coatings of pipes and fittings,
- Cement mortar to repair interior linings of pipes and fitting.

(c) For the external protection of mechanical couplings and flanged joints, the Contractor shall be provided Denso or similar products.

(d) The contractor shall also provide and install warning plastic mesh or grid material to place over the pipes after laying as shown on the Drawings. The Width of the mesh or grid shall be 0.3m.

3.2 Contractor's Responsibility for the Pipes and Materials

(a) The Contractor shall be deemed to entirely responsible for every aspect of the pipes and fitting and equipment from the time he takes delivery of the said pipes and fittings until the completed installation is formally taken over by the Water District.

(b) Any damage to, or losses of pipes, fittings and equipment, including all the gaskets bolts and special tools whatsoever that have been provided by Contractor to install shall be replaced free of cost to the Water District. Alternatively the Water District shall deduct from the payments due to the Contractor the full cost of the goods involved plus an amount of [20]%.

3.3 Pipe Handling

(a) Only plant of appropriate capacity and purpose made equipment may be used for handling the pipes and fitting, which shall always be supported in accordance with the manufacture's recommendations or other approved manner, to protect the pipe ends and fitting or specials from injury.

(b) Pipes and fittings in storage, whether of short or long term duration, shall always be properly supported.

(c) Pipes and fittings and materials shall not be subjected to any impact or other treatment that might damage the pipe or its protective surfaces.

3.4 Transportation

(a) Any vehicle on which pipes are to be transported shall have a body of such length that the pipe do not overhang.
(b) Pipe of DN300mm and above shall be place on cradles.
(c) Pipes and fittings shall always be properly secured against movement shall also be protected from chafing and surface damage during transport.

3.5 Delivery to Site

(a) The Contractor shall make all arrangements for the timely delivery of the correct pipes from the pipe storage area, to the trench side, or to adjacent temporary storage areas to suit the Contractor's program and the nature of the general site conditions.
(b) Temporary storage of rubber gaskets, bolt, small fittings shall be in secure conditions, and protected from UV light and the weather generally until installed
(c) At all times there shall be sufficient quantities of pipe and fittings at each pipe laying location to ensure continuous installation progress, within the maximum period prescribed.
(d) Any pipe or special damaged in transit or delivery to the trench sites shall be replaced or repaired if approved by the Project Manager, all at the expense of the Contractor.

4. Pipe-laying and Installation

4.1 General

(a) The Contractor shall provide labor, materials, tools, equipment, and plant for the installation and handing, laying and installation of the pipes and fittings to the lines, grades and elevations shown on the Drawings.

4.2 Pipes to be Clean

(a) Pipes and fittings shall be carefully cleaned of foreign substances which may have been collected therein before installation and kept clean at all times thereafter, to ensure that there is no difficulty later with flushing and sterilization of the pipe lines on completion.
(b) Before leaving the work for the night or for holidays or at other times when pipe installation is to stop, all pipeline ends shall closed with suitable wood or metal bulkheads to prevent ingress of animals

or persons the Contractor shall make all necessary arrangements to maintain dewatering pumps in operation so that the pipeline do not fill with dirty water.

(c) The Contractor shall be deemed responsible for any delays caused to his installation program arising from his failure to keep the interior of the pipes clean.

4.3 Inspection of Pipe at Trench Site

(a) Each length of pipe shall be carefully examined before it is lowered into its laying position to ensure that only new undamaged pipe shall be installed following the approval of the Project Manager.

(b) Any pipes found damaged shall be rejected and removed from the site for repair, cutting off the damaged portion if short, or disposal, subject to the opinion of the Project Manager.

4.4 Pipe Cutting

(a) Cutting of pipes shall be carried out in accordance with the pipe manufacture's recommendations, without damage to the pipe or the protective coating, and so as to leave a smooth face normal to the pipe axis, chamfered as necessary for subsequent jointing.

(b) All cutting shall be done with proper cutting tools and apparatus, and the Contractor shall always be responsible for the accuracy of the measurement of the cut pipe required.

(c) With ductile iron pipes, the cut ends shall be coated with quick drying epoxy paint to the approval of the Project Manager which shall be dry before the joint is made.

(d) The Contractor shall remove all unused offcuts from the site on completion, and return them to the Water District's stores. Such offcuts shall be set against the Contractor losses, provided the offcuts did not arise from the repair of damaged pipes.

4.5 Pipe Bedding

(a) Bedding shall form a continuous, sound and uniform bearing for the full length of the pipe except for small grooves for removal of sling, and at the ends of joint.

(b) All such grooves shall be filled and thoroughly compacted with bedding material after removal of the sling and completion of jointing.

4.6 Pipe Installation

(a) Pipes shall be carefully lowered into the trench.

(b) The bedding shall have been prepared and compacted to the required line and level, so that the pipe will be lowered directly onto the bedding. Temporary supports on blocks will not be permitted.

(c) Larger pipes should be supported by the crane during jointing to reduce the jointing effort.

4.7 Flotation

(a) The Contractor shall take all precautions necessary to prevent pipes from floating due to accidental flooding of the or from any other cause, and shall be responsible for the consequential cost of remedial work delays.

(b) The Contractor shall include details of precautionary methods proposed for pipe restraint with his method statements for the execution of the work.

4.8 Jointing

(a) Spigot and Socket Type

- The spigot and socket to be joined shall be thoroughly cleaned just before joining and the joint rubber gasket and lubricant supplied by the manufacturer shall be installed and applied in accordance with the manufacturers' recommendations.
- When a joint deflection is needed to accommodate a grade or an alignment adjustment, the deflection should be made only when the joint has been made as described above.
- The amount of the joint deflection must not exceed the limits imposed by the design or recommended by the manufacturer.

(b) Mechanical Couplings

- In the case of mechanical couplings the bolts shall be tighten gradually so that the components of the coupling are drawn together uniformly.
- The manufacturer's recommendation shall be followed.

(c) Flanged joints

- Flanged joints shall be completed in like manner, and in accordance with the manufacturer's recommendations as regards maximum torque applied to bolts.

(d) Joint for Polyethylene Pipes

- Polyethylene pipes shall be joined with push-in fittings (female-female couplers either straight, 90° bends, or T-pieces as per the specifications.

(e) Pipe Sleeving

- Wherever indicated on the drawings, or ordered by the Project Manager, polyethylene sleeving, provided by the Contractor shall be installed to cover the exterior of ductile iron pipes.
- Prior to installation, the sleeving shall be stored out of direct sunlight, and during installation such exposure kept to a minimum.
- Sleeving of appropriate size for the pipe being installed shall be slipped over the pipe before it is lowered into the trench, and fixed in accordance with the manufacturer' recommendations to ensure a tight, neat water proof fit a long the whole length of the pipe.
- After jointing the pipes and installation of the fittings, sleeving of appropriate size shall be installed around the joints and fittings.

4.9 Valves

(a) Valves in the Ground

- Generally, DN 350mm and smaller valves shall be placed directly in the ground when not installed in chambers with larger valves.
- The valves are provided with surface boxes and protection tubes, and shall be installed, and supported on a concrete block as shown on the drawings.

(b) Valves in Chambers

- Valves for installation in chambers shall be hand-wheel operated and installed as shown on the drawings.

(c) Thrust Blocks and Restraints

- Bends, plugged ends, tees and tapers shall be well braced against undisturbed earth by the use of concrete thrust blocks, as shown on the typical drawings.
- Thrust blocks shall be installed at every location where they are required, even if not specially shown or detailed on a drawing.
- Where faces of anchor blocks are shown or detailed as having an area or dimension to bear against undisturbed ground, the Contractor shall take all necessary measures to ensure that the minimum dimensions are achieved.

(d) External Protection of Joints

- Mechanical couplings, flanged joints and saddle straps shall protected on site by the cold application of Densyl tape or similar approved material supplied by the Contractor.

- Application of Densyl tape with Denso Primer, Densyl Mastic and Outerwraps shall be strictly in accordance with the manufacturer's recommendations

5. Connections to Existing Water Mains

5.1 Connection shall be made at the location shown on the drawings, from existing plugged ends or from lines to be cut.

5.2 The level of an existing line shall be accurately ascertained by the contractor and the exact details of all the materials and other requirements determined and listed in a detailed method statement to be submitted for the approval of Project Manager.

5.3 The Contractor must have the approval of the Project Manager and the Water District before any work is started and the Water District shall have made arrangements for the closing off of supplies as well as proposing the most appropriate time for the shut-down.

5.4 The Contractor must consider execution of such connections as early in the program as practicable, because the Water District will need to select a time when there will be least interference to the network and will not accept any requests for extensions of the Contractor period arising from delays in finding a suitable time for the connections.

6. Fire Hydrants

-Connections to Existing Water Mains: Connection shall be made at the location shown on the drawings, from existing plugged Leaking of non-functional fire hydrants shall be replaced at the same location or as instructed by the Project Manager.

7. Services Connection

7.1 General

(a) Service Connections shall be carried out in accordance with the typical arrangement shown on drawing, to run from the pipe saddle and the corporation stop horizontally (at the depth of the main pipe) to a 90° elbow and then vertically to the 90° stop cock before the customer meter. The contractor's responsibility ends with the installation of the stop cock.

(b) If an existing service connection is replaced by a new service connection, the old pipe saddle has to be removed and the old tapping hole has to be covered with a stainless steel repair clamp (as specified in 3.7 of Part G) and the new pipe saddles has to be installed as per the description above.

(c) The sizes of the service connections shall be designed based on customer's consumption.

(d) The Contractor shall prepare trenches for the service connections generally in accordance with the pipeline trenching requirements, and the reinstatement and compaction of the backfill follow the same procedure.

7.2 Interruption of supplies to consumers

(a) The supply to any consumer's premises shall not be interrupted for more than one working day while the new service connection is made.

(b) The Contractor shall be responsible for ensuring that the individual consumers are informed in advance of the timing and duration of any shutdown and for ensuring the access is available to the premises for the execution of the work necessary.

7.3 General installation procedure

(a) As much of the new service connections as practically possible shall be completed up to the surface, ready for jointing with the existing stop cock and water meter or for removal of the stop cock and water meter and their replacement.

(b) Upon completion of the service connection as above, jointing with the existing stop cock and water meter or removal and replacement of these facilities shall be executed depending on how the existing supply can be discontinued and shall be in accordance with one of the following alternatives, where either:

- All the service connections supply by an existing distribution line may be isolated by the closure of an existing valve such that when distribution line is closed, all the service connections can be completed and tested during the course of one working day or working night as authorized by CLIENT regulations, or
- Each service connection is connection is completed on an individual basis and the existing supply cut off by either
  - (i) Closure of the corporation cock on the existing main – if there is one, or
  - (ii) Installation by the Contractor of an effective water tight valve or stopper in the existing service line,

(c) In either case the contractor shall provide all the necessary labor plant and equipment for the stopping of the existing supply to the service connection.

7.4 Pipe Saddles

(a) The installation of pipe saddles on new or existing pipes shall be carried under pressure.

(b) The Contractor shall follow the detailed procedures of the manufacturer and supplier of the under-pressure pipe equipment to install and secure the pipe saddles and to connect the corporation stops to them.

(c) The pipe saddles shall generally be installed horizontally, unless otherwise by the Project Manager.

8. Customer meters- The replacement of existing or installation of new customer meters shall not be done by the contractor unless otherwise instructed by the Project Manager.

9. Ownership of meter and materials

9.1 All existing meters, valves and fittings shall remain the property of the Water District. New customer meters will be supplied by the Water District.

9.2 The Contractor shall return all meters valves and fittings removed to the Water District complete and undamaged, other than by marks and scoring necessarily arising from the removal of the items. The contractor is not expected to dismantle all the component pieces of the assemblies except if required for removal.

9.3 Where meters assemblies are not returned complete as indicated above, the Water District will deduct 50% of the cost of the supply of the same assembly in the new condition at current prices from the amount due to the contractor for payment under the contractor.

D. PRESSURE TESTING

1. General

1.1 Field tests shall be applied as soon as practicable after installation and in any event before connecting to any existing service.

1.2 Before service connection installation may start, the distribution network shall be tested in sections, as they are completed, to confirm that the completed installation will withstand the test pressures applied without movement of any pipe or component and without leakage in excess of the allowance.

1.3 The Contractor shall provide all the labor and equipment whatsoever necessary for the testing operation.

1.4 Upon completion of the testing and connection to supply contractor may proceed with the service connections.

1.5 Any question as to whether a pipeline or any section of it is complete for the purposes of hand over will not be considered until testing is complete.

2. Water for testing

2.1 Only potable water shall be used for testing and the contractor shall obtain and pay for the water to test the pipeline

2.2 The Contractor shall submit all details of the source and condition of the water proposed for testing to the Project Manager for approval.

3. Stopends

3.1 The Contractor shall take all measures necessary and shall provide all the material necessary for the construction and installation of stop ends and bracing to withstand the forces generated by the test pressures and the forces distributed to undisturbed sound ground or to existing or specially constructed structures.

3.2 The Contractor shall provide detailed of the bulkheads or end closures proposed, and should incorporate facilities for the release of air.

3.3 The numbers and location of stop ends will depend on the contractor's overall program of works and the length of section to be tested.

4. Distribution pipelines

4.1 The pipeline shall be backfilled as far as necessary to provide restraint of the pipes under the test pressure, particularly at or near bends or stop ends.

4.2 All temporary and permanent pipeline restraints shall be properly installed prior to the application of the test pressure.

4.3 Where the Contractor has substantially completed backfilling before testing, for whatever reason, he is still liable for the cost and time needed to search and remedy any defective joint or joints discovered by the testing.

5. Service connections

Every service connection shall be tested individually .The test shall be applied between the closed corporation cock and the angle meter valve and the test pressure applied at the outlet point of the angle meter valve.

6. Filling

6.1 Lines should be filled as soon as practicable after laying, form a low point, at a rate that will avoid possible water hammer and development of excessive pressures.

6.2 Pipes with cement linings shall be kept filled and with a pressure of about 3 bar applied for 24 hour before hydrostatic test is made; plastic and non-absorbent pipes may be filled and tested immediately.

6.3 Any leaks revealed during the filling and soaking stage shall immediately be repaired with costs and delays to the contractor's account.

7. Test pressures

Distribution pipes and service connection shall be tested to 6 bar pressure, measures at the lowest elevation of the pipe under test, only if this makes any significant difference to the actual pressure applied, as the area is generally flat.

8. Application of pressure

8.1 The test pressure shall be applied, using a pump of suitable pressure and delivery capacity and the amount of leakage shall be measured by drawing from either:

(a) An approved calibrated water tank or

(b) A suitable calibrated water meter obtained from the Water District.

8.2 When the hydrostatic test pressure has been obtained in the pipeline, this pressure shall be maintained for not less than 1 hour.

8.3 Regardless the actual measured leakage rate, all detectable leaks should be stopped whether form the pipe or any appurtenances. After repairs to correct detectable leaks, the pipeline shall be refilled and the test pressure reapplied. This process shall be repeated until no further leaks can be detected to the approval of the Project Manager.

8.4 The cost of all work whatsoever necessary to locate and repair leaks or other detects which may develop under the test, and subsequent to secure the required tightness shall be borne by the contractor.

8.5 The contractor shall carefully restore any sections of the pipeline excavated for the purpose of locating leaks to their original condition or to the condition required under the terms of this contract.

9. Permitted leakage rate

9.1 The volume of leakage shall be measured during a test period of not less than1 hour at the defined test pressure and shall not exceed the rate

amount needed to maintain the pressure constant throughout the test period and determined form the following formula:

(a) V = 1/715 x L x D x $\sqrt{P}$ litres/hour

(b) Where L is the length of the pipe in m, D is the nominal diameter of pipeline in mm and P is the test pressure in kPa (with P = 600 kPa)

9.2 After the pipe has successfully met all the test requirements, cleaning, flushing and sterilizing of the line shall proceed as provided below

9.3 Upon acceptance of test results by the project manager, backfilling of the section of pipeline may be completed if not already complete.

E. DISINFECTION OF PIPELINES

1. General

1.1 All potable water pipe, fitting, valves, meters and appurtenances shall be disinfected by the Contractor as specified herein, unless otherwise directed by the Project Manager.

1.2 All water and chlorine required for disinfection of pipelines shall be provided by the Contractor at his own expense.

1.3 Bacteriological testing will be performed by an approved laboratory.

2. Interior of pipes to be kept clean

2.1 The Contractor shall again note clause 5.3 hereof, and take extreme care to prevent ingress of dirt or foreign materials of any kind into the pipework.

2.2 If in the opinion of the Project Manager, dirt or other foreign material has entered the pipework, which cannot be removed by flushing, the Contractor shall clean and swab the interior of the pipework with a five percent sodium hypochlorite disinfecting solution, to loosen and remove such foreign materials, to the satisfaction of the project management.

3. Cleaning and disinfection

3.1 The Contractor shall provide all labor, attendance, equipment, materials and testing apparatus, as may be necessary for the effective disinfection of all pipeline, and shall provide all the labor and attendance and the course thereof that are required to obtain the approval and certification of the Project Manager.

3.2 After testing immediately before commissioning, all pipeline shall be washed out and disinfected as follow:

(a) All mains shall be flush out with clean water until there is no evidence of foreign mater or color in the waste flushing water.

(b) A stock disinfecting solution shall be prepare by mixing for about 5 minutes, in clear container, solution hypochlorite solution (15% available chlorine) and distilled water in the proportion of 0.8 litres to 1000 litres water by volume. Stock solution shall be made up fresh daily.

(c) The main to be disinfected shall be filled with potable water at the same time as the stock solution is added, through a convenient connection point, and in such quantities (to be determined by the Contractor and approved by Project Manager) as will result in a final solution containing 50mg/l free chlorine.

(d) Care shall be taken to ensure that the stock solution is added at the constant rate, commencing when water is fed into the main and ending as soon as the main is filled.

3.3 Every main charged with disinfection solution shall stand for 24 hours, after which sample shall be taken at a washout valve by the Contractor in the presence of the Project Manager, from whom sterile sampling bottle shall be obtained and tested for free chlorine, for action as follows:

(a) If the sample does not show at least 2mg/l free chlorine, disinfection shall be repeated.

(b) If the sample is satisfactory the main shall be emptied, flushed out and filled with treated water and allowed to stand for 1 hour.

3.4 Two samples shall then be taken as before one for a further determination of free chlorine and the other, in a sterilized bottle, for bacteriological analysis for action as follows:

(a) If the free chlorine determination shows more than 4mg/l free chlorine the main shall be flushed out again.

(b) If the bacteriological analysis is unsatisfactory, disinfection and sampling shall be repeated until satisfactory results are obtained before the main is commissioned.

4. Certificate of Completion

When the entire pipeline has passed this test, and provided all other requirements of this Contract have been met, the Project Manager will issue a Certificate of Completion in accordance with the Conditions of Contract.

F. LEAK REPAIR

1. Leaks on main pipelines
   1.1 Leaks on main pipelines shall if possible be repaired by using stainless steel repair clamps. In case the damage is too large (e.g., longitudinal split) the damaged pipe shall be replaced by a new section of pipe, connected to the old pipe with flexible joints or flange adaptors.

   1.2 Intrusion of ground water into the main pipe has to be avoided as far as possible.

2. Leaks on service connections
   2.1 Leaking service connections shall be entirely replaced, from and including the pipe saddle until the customer meter.

   2.2 The only exception when a leaking service connection may be repaired and not replaced is when the fittings near the customer meter are leaking and the problem can easily and durably be fixed.

   2.3 Service connections have to be installed in accordance with the design drawing No. [ ] to be found in Section X – Drawings

   2.4 Service connection fittings, other than the fittings specified in CSP J 3.3, like one-way valves and stop cocks before and after the meter, shall be in accordance with the Water District's commonly used materials.

3. Leaking valves
   3.1 Leaking sluice valves inside the DMA or boundary valves of the DMA shall be replaced with new valves, even if only the stuffing box (gland) is leaking.

   3.2 Valves shall be installed complete with extension spindle, protecting tube and surface box.

   3.3 In case leaking valves are found outside of the DMAs, the Contractor shall report them to the Project Manager who will decide if and by what technical means the valve shall be repaired or replaced.

4. Leaking fire hydrants
   4.1 Leaking fire hydrants shall be replaced by new hydrants.

   4.2 Fire hydrants found with other operational deficiencies shall be reported to the Project Manager and will be dealt with by the Water District unless otherwise instructed by the Project Manager.

5. Other leaks
   Other miscellaneous leaks shall be repaired using appropriate standard industry technologies.

G. DMA INFLOW CHAMBERS

1. The DMA inflow chambers shall constructed according to a standardized design that the Contractor shall develop and submit for approval to the Project Manager. The design shall in principle be based on drawing.

2. Chamber covers shall be lockable and might be either heavy duty cast iron covers or steel covers – depending on the location of the chamber in respect to heavy traffic. Chamber covers have always to be approved by the Project Manager.

REFERENCES:

Republic Act No. 6975, as amended by R.A. 7718, The Philippine Amended BOT Law, and its Revised Implementing Rules and Regulations (2012)

Presidential Decree No. 198, as amended, or the Provincial Water Utilities Act of 1973

Draft Bulk Water Supply Agreement at http://ppp.gov.ph/wp-content/uploads/2011/03/Bulk-Water-Supply-Sample-Contract.pdf

Saigon Water Corporation, *Performance-based Leakage Reduction and Management Bid Document (Sanitized)*, The World Bank, 2012

Marin, Philippe, Senior Water & Sanitation Specialist, Water Division, Sustainable Development Dept., World Bank, Personal Interview, January 2, 2013

Kingdom, Bill, Senior Water & Sanitation Specialist, Water Division, Sustainable Development Dept., World Bank, Personal Interview, February 12, 2013

ANNEX: ILLUSTRATIVE FINANCIAL MODEL BASED ON PERFORMANCE FEES FOR COST RECOVERY

The draft contract mentions that the bid price for the performance fee will be stated as a base rate per cubic meter – essentially a portion of the tariff per cubic meter – of water saved given a target volume of water savings or water loss reduction. In setting up a financial model and simulating the bid price, two basic objectives must be balanced: the price must give the contracting company's equity holders a sufficient rate of return and, at the same time, it must not unduly burden the consumers with high tariff.

In this illustrative financial model, the assumptions and the setup of the building blocks are simplified. Only the basic components needed to lay down the requisites for solving the bid price are demonstrated.

Some of the basic assumptions have already been mentioned in Section III. Example Technical Contract Provisions of this draft contract. These are summarized as follows:

Table 1. Basic Assumptions

Target non-revenue water reduction (or water savings) per day					40,000 m^3/day
Target total number of District Metering Areas (DMA)					40 DMAs
distributed as:					
	year 1	year 2	year 3	year 4	year 5
DMAs per year, cumulative	5	15	25	35	40
Water savings, cumulative (m^3)	2,000	10,000	20,000	30,000	40,000
Number of connections per DMA					1,000
Existing tariff ($/$m^3$)					0.50

Given the DMA targets, the water savings targets, and reasonable assumptions on cost components, the project cost schedule can be projected as follows:

Table 2. Project Cost Schedule

	Year 1	Year 2	Year 3	Year 4	Year 5
Project Cost Schedule					
(a) Project Feasibility Assessment Cost	600,000				
(b) General Fixed Cost	2,000,000				
(c) DMA Establishment Works	150,000	300,000	300,000	300,000	150,000
(d) Leakage Reduction and Management Services	442,353	771,765	1,183,529	1,595,294	2,007,059
Estimated Fixed Cost	360,000	360,000	360,000	360,000	360,000
Estimated Variable Cost	82,353	411,765	823,529	1,235,294	1,647,059
(e) Pipe Replacement	900,000	1,800,000	1,800,000	1,800,000	900,000
(f) Maintenance Expenses, first 5 years	125,000	375,000	625,000	875,000	1,000,000
Project Cost	**4,217,353**	**3,246,765**	**3,908,529**	**4,570,294**	**4,057,059**
TOTAL PROJECT COST					**20,000,000**

It is also assumed that the financing plan of the contractor is this:

Table 3. Financing Plan

Total Required Financing (total of years 1 to 5 project cost) = **$20,000,000**			
Debt Financing		**Equity Financing**	
Debt (in %)	70%	Equity (in %)	30%
(in $)	14,000,000	(in $)	6,000,000
Interest rate	9%	Return on equity	20%
Repayment period	10 years		
Commitment fee	0.13%		

The cost of money assumptions are based on the current financing environment, e.g., private and government banks' terms for water districts in some recently concluded transactions wherein an approximate 9% interest rate for a 10-year loan can be inferred. Debt-equity mix is put at 70% debt financing and 30% equity financing. It is also assumed that the required return on equity is 20%. Given the assumed cost of debt and cost of equity, the weighted average cost of capital (WACC) is computed as 12.3%. For undrawn amounts of the projected loan amount, it is assumed that a 0.13% commitment fee will be imposed; this is patterned after a local commercial bank's practice of imposing a commitment fee of 1/8 of 1% for a domestic letter of credit.

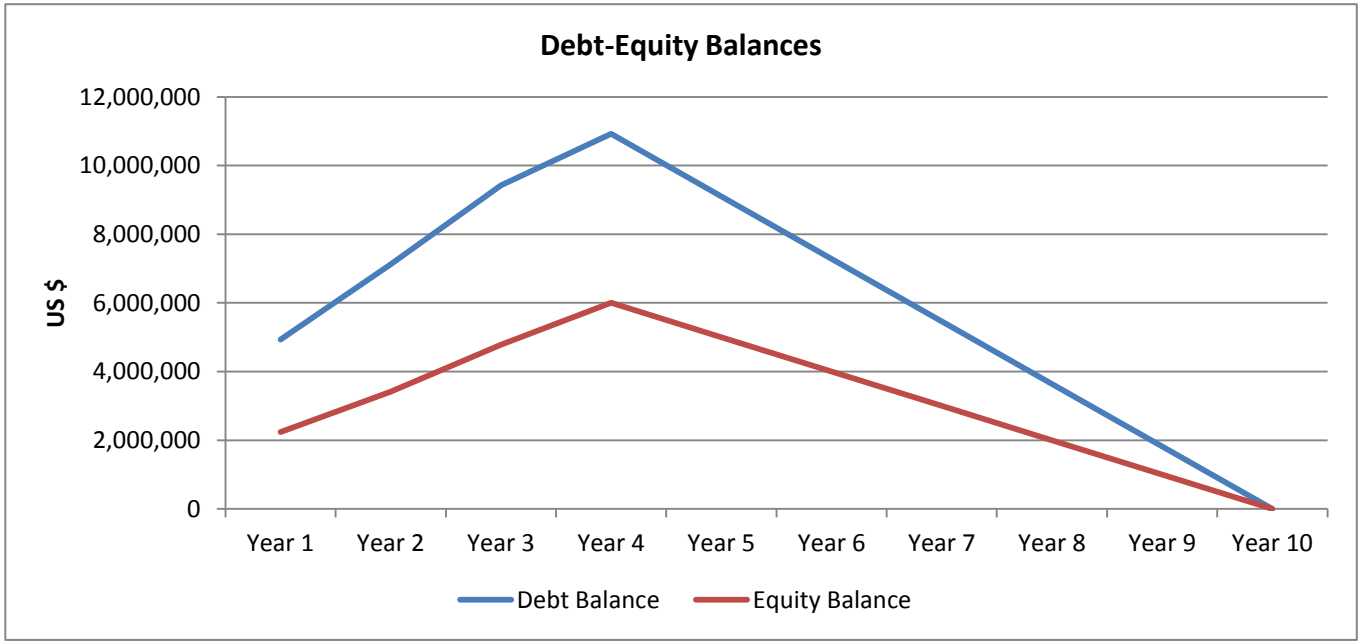
The contractor's financing schedule can be projected as follows:

Table 4. Contractor's Financing Schedule

	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Financing Schedule											
Debt Financing											
Loan Drawdown, 5 years (based on planned utilization)	2,952,147	2,272,735	2,735,971	3,199,206	2,839,941						
Commitment fee on undrawn amount		13,810	10,969	7,549	3,550	0					
Interest Payment		265,693	443,670	640,611	848,463	982,849	819,041	655,232	491,424	327,616	163,808
Loan Repayment		295,215	547,741	889,737	1,346,767	1,820,090	1,820,090	1,820,090	1,820,090	1,820,090	1,820,090
Loan Principal Balance	2,952,147	4,929,668	7,117,897	9,427,366	10,920,541	9,100,451	7,280,360	5,460,270	3,640,180	1,820,090	(0)
Equity Financing	1,265,206	974,029	1,172,559	1,371,088	1,217,118						
Equity Repayment						1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000
Equity Balance	1,265,206	2,239,235	3,411,794	4,782,882	6,000,000	5,000,000	4,000,000	3,000,000	2,000,000	1,000,000	0

The debt-equity balances graphically look like this:

Figure 1. Debt-Equity Balances



If the model is properly set up, spreadsheet calculation techniques (e.g., Solver in MSExcel) can be used to calculate the proportion of the existing tariff that will yield the base fee or the bid price. The considerations in this specific model are: the bid price must result in a rate of return to equity holders of at least 20%; and, at the same time, the bid price must ensure that the water district will not have to raise its existing tariff of $0.50 in order to meet its performance fee obligations, especially during the first few years when the water sales are still low. It is assumed that 65% of the water saved will be sold in year 1, 70% in year 2, 75% in year 3, 80% in year 4, and 85% in years 5-10.

The calculation yielded a possible minimum proportion of 79% of the existing tariff (i.e., bid price of $0.39/$m^3$), which means, for as low as this bid, the contractor can earn and equity IRR of 20%. The maximum possible proportion, on the other hand, is 83% (i.e., a bid price of $0.41/$m^3$), which means, at anything higher than this, the water district will have to raise tariffs in order to increase its revenues from the water sales and be able to pay the performance-based fees. Moreover, proportions close to 83% result in revenue shortfalls by the water district for many years, until a few years before the end of the contract period, although the break-even point is still achieved within the ten-year period.

Assuming that the sample winning bid is 79% of the existing tariff and given an existing tariff of $0.50 per cu.m., the base fee for every cubic meter of water saved is $0.39. This performance fee results in the following revenue schedule:

Table 5. Contractor's Revenue Schedule

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Revenue Schedule (Performance-Based Fees)										
Target Water Savings:										
Target water savings, incremental(m3/day)	2,000	8,000	10,000	10,000	10,000					
Target water savings, cumulative (m3/day)	2,000	10,000	20,000	30,000	40,000	40,000	40,000	40,000	40,000	40,000
No. of days in a year 365										
Target water savings per year (m3)	730,000	3,650,000	7,300,000	10,950,000	14,600,000	14,600,000	14,600,000	14,600,000	14,600,000	14,600,000
Base Fee per m3 ($/m3)	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39
(to be paid only when the target water savings are realized)										
Contractor's Revenues (Performance-Based Fees)	286,948	1,434,739	2,869,478	4,304,218	5,738,957	5,738,957	5,738,957	5,738,957	5,738,957	5,738,957

The cash flows for equity holders can thus look like this:

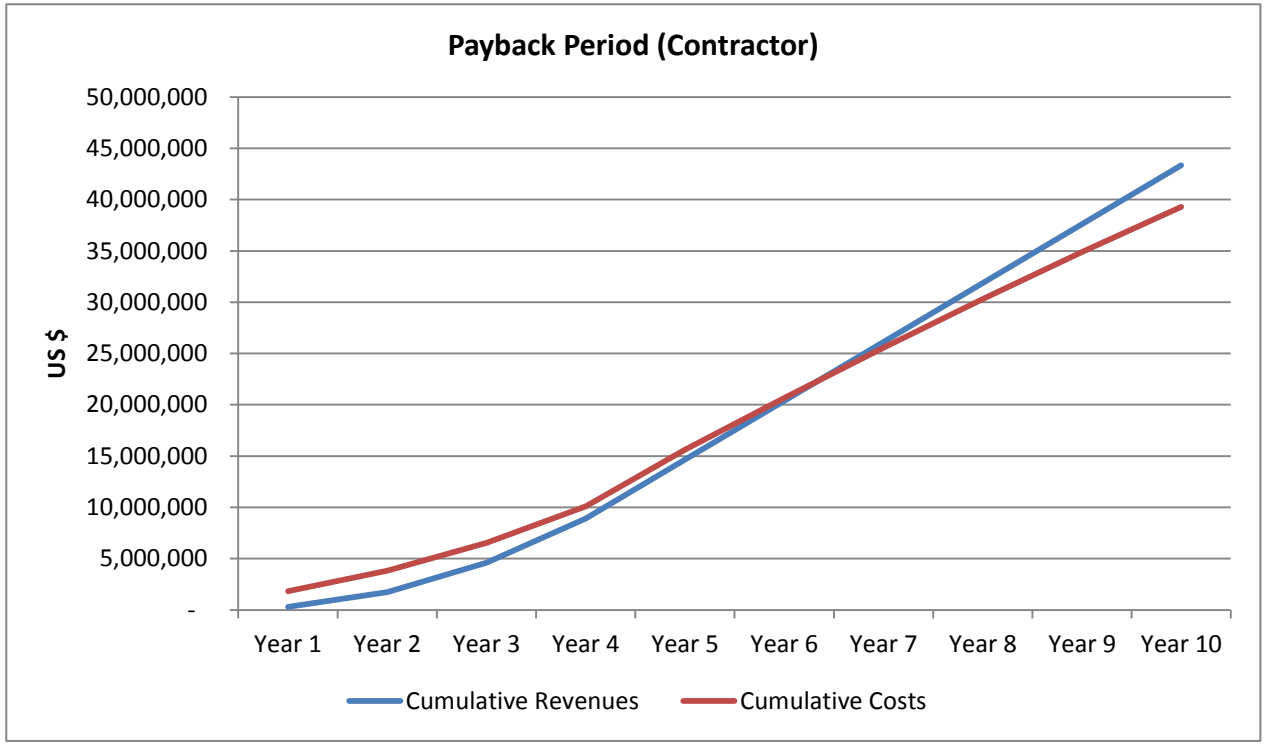
Table 6. Cash Flows for Equity Holders

Project Cash Flows											
	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Equity Investment Perspective											
Revenues		286,948	1,434,739	2,869,478	4,304,218	5,738,957	5,738,957	5,738,957	5,738,957	5,738,957	5,738,957
Less: Equity Investment Cost		1,265,206	974,029	1,172,559	1,371,088	1,217,118					
O&M Cost						1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000
Total Debt Service		574,718	1,002,380	1,537,897	2,198,779	2,802,939	2,639,131	2,475,323	2,311,514	2,147,706	1,983,898
Tax		-	-	-	-	504,569	1,421,687	1,421,687	1,421,687	1,421,687	1,421,687
Net Cash Flows, Equity Investment Perspective		(1,552,976)	(541,670)	159,023	734,350	214,331	678,139	841,947	1,005,755	1,169,564	1,333,372
Equity IRR = 20%											
WACC = 12.3%											
NPV given WACC = 820,813											

Note from the cash flow schedule that its $0.39 bid price resulted in an equity IRR of 20 percent, satisfying the minimum required return of its equity holders.

Note also that the payback period for the contractor is 7 years, as depicted by the graph below:

Figure 2. Payback Period – Contractor's Point of View



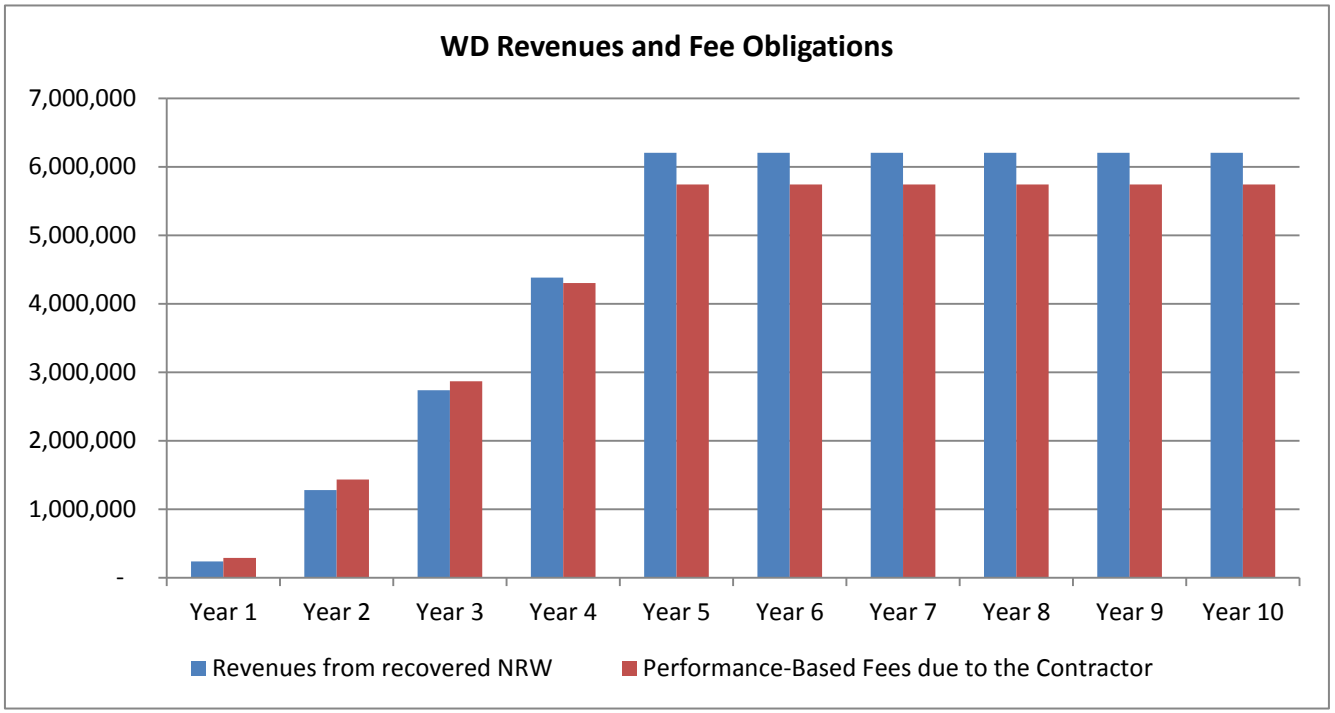
Given the performance fee obligations and assumptions on the ability of the water district to sell the recovered water, the water district's revenue schedule can be projected as follows:

Table 7. Revenue Schedule of the Water District

		Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Revenue Schedule of the Water District											
NRW recovered per year (m3)		730,000	3,650,000	7,300,000	10,950,000	14,600,000	14,600,000	14,600,000	14,600,000	14,600,000	14,600,000
Existing Tariff ($/m3)		0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Tariff Increase (one-time increase)	*0%*										
New Tariff ($/m3)		0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Value of NRW recovered ($)		365,000	1,825,000	3,650,000	5,475,000	7,300,000	7,300,000	7,300,000	7,300,000	7,300,000	7,300,000
Sales improvement		*65%*	*70%*	*75%*	*80%*	*85%*	*85%*	*85%*	*85%*	*85%*	*85%*
Revenues from recovered NRW		237,250	1,277,500	2,737,500	4,380,000	6,205,000	6,205,000	6,205,000	6,205,000	6,205,000	6,205,000
Performance-Based Fees due to the Contractor		286,948	1,434,739	2,869,478	4,304,218	5,738,957	5,738,957	5,738,957	5,738,957	5,738,957	5,738,957
Revenue Shortfall		49,698	157,239	131,978	-	-	-	-	-	-	-
Excess Revenues		-	-	-	75,782	466,043	466,043	466,043	466,043	466,043	466,043

Note above that there will be some revenue shortfalls from years 1 to 3, and then excess revenues starting year 4 (see also Figure **3** below). If the water district has free internally generated cash, then these revenue shortfalls can be financed internally. The water district may also try to finance these shortfalls through short-term debt, externally or through the private contractor. It is assumed that short-term debt can be secured at an interest rate of 3.79 percent per annum.

Figure 3. Water District Revenues and Performance Fee Obligations



The anticipated free cash flows for the water district are as follows. The whole undertaking is expected to result in a net present value of $858,704.

Table 8. Free Cash Flows for the Water District

Free Cash Flow of the Water District															
					Year 1	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Year 6**	**Year 7**	**Year 8**	**Year 9**	**Year 10**
Revenues					237,250	1,277,500	2,737,500	4,380,000	6,205,000	6,205,000	6,205,000	6,205,000	6,205,000	6,205,000
Add: Proceeds from Short-Term Debt Financing					49,698	157,239	131,978	-	-	-	-	-	-	-
Less: Performance-Based Fee Obligations					286,948	1,434,739	2,869,478	4,304,218	5,738,957	5,738,957	5,738,957	5,738,957	5,738,957	5,738,957
Net Revenues					-	-	-	75,782	466,043	466,043	466,043	466,043	466,043	466,043
Less: Short-Term Debt Repayment						-	-	75,782	263,133	-	-	-	-	-
Less: Interest Expense						1,884	7,846	12,851	9,977	-	-	-	-	-
Tax Obligation: None (because income tax-exempt; franchise tax will come from regular operations and not from NRW reduction activity)														
Free Cash Flow of Water District					-	(1,884)	(7,846)	(12,851)	192,933	466,043	466,043	466,043	466,043	466,043
cost of capital (public fund):		15%												
Solver Objective: NPV = 0			858,704											
Solver Variable: One-time increase in tariff			0%											